THE

Malayan Agricultural Journal

JUNE 1930.

EDITORIAL.

Agricultural Shows and Exhibitions.

The Seventh Malayan Exhibition, held at Kuala Lumpur last month prompts one to a consideration of the scope and utility of agricultural shows and exhibitions.

An Exhibition infers that several branches of a dissimilar nature are grouped around a central idea; whereas a Show is a competition in the various classes grouped in a schedule. Therefore, while the latter aims at stimulating improvements by fostering the competitive spirit, the former attempts to instruct in all branches, to demonstrate the most recent advances and encourage their ready adoption.

The Malayan Exhibition is organised by the Malayan Agri-Horticultural Association, and it is therefore assumed that the object of their annual exhibition is not merely to foster the competitive spirit, but to bring to one centre the various factors affecting the progress of agriculture in this country.

Of paramount importance in the development of agriculture in Malaya is the question of health, for without maintaining the health of the agricultural community the development of new land is impossible. It was therefore satisfactory to note that the Public Health Education Committee established a permanent building, containing a mass of material to demonstrate the essential facts concerning health, all effectively labelled in more than one language; and that they gave frequent demonstrations. The crowds of spectators visiting this Section is evidence of the interest which it commanded.

The Department of Agriculture and the Rubber Research Institute of Malaya shewed a proper appreciation of the situation; by means of well staged and labelled exhibits and of pamphlets printed in the English, Malay, Chinese and Tamil languages, they were able to give the spectators something useful to take away after hearing the short lectures delivered at frequent intervals throughout the day.

The other important Section was that of Village Industries. The Association has rightly insisted that all exhibits in this Section should be for sale. The sales are organised by the Association and the proceeds sent to the owners.

Many of these owners live far from large centres of population and they therefore appreciate the fact that a market for their goods is being provided through the medium of these Exhibitions. We have stated that this section is an important one. Village agriculture consists mainly in rice, rubber and coconut production, which generally do not fill the time of the owner throughout the year, or throughout the day. The existence of means of supplementing his income is therefore frequently welcome to the cultivator and is not an insignificant factor towards making life in the village more attractive. Any means that can be devised to persuade the agriculturist to remain on the land is worthy of encouragement and it is for this reason that we regard village industries as important.

Less worthy of favourable comment were the agricultural exhibits submitted for competition. The exhibits of rubber and coconut products were very disappointing, both in quantity and quality and we doubt whether the native agricultural industries were sufficiently representative. These sections require the careful consideration of the organisers before the next Exhibition.

The inclusion of a Trade Section is of value in demonstrating the relationship of engineering to agriculture.

The Exhibition was well conceived, and organised. Its most important features were distinctly educational and its range such as to be attractive to all conditions of visitors.

Pepper.

Attention is directed to the article which appears in this number of *The Malayan Agricultural Journal* on Pepper Cultivation in Malaya by Mr. J. N. Milsum. The article proves that pepper can be successfully cultivated in Malaya. While there is no scope for the cultivation of this product as a major crop, it is rather amazing to find there are no areas under pepper in Malaya. One of the difficulties in exploiting a crop not usually cultivated in a particular country is that of finding an established market. This does not apply to pepper, for there is a long-established market for it in Singapore. The Singapore trade in 1929 dealt with between 12,000 to 13,000 tons of pepper valued at about $17,500,000.

Insect Pests of Padi.

A preliminary general account is given in this number of the *Malayan Agricultural Journal* of the principal insect pests attacking padi. The need for greater attention to the production of rice in the Peninsula and for the enhancement of returns from padi areas, calls for increased attention to all factors likely to reduce the size of the crop, and in this connection damage caused by insect pests is of importance.

It is well that it should be realised that padi is a crop which is subject to depredation by a large number of insect pests, and there is little doubt that in the aggregate, they are responsible for considerable reduction in crop; while as padi is grown entirely as a native crop such depredations may frequently escape unnoticed until the damage becomes very serious.

Particular interest centres in the attempts now being made by the Entomological Division to control attacks of padi borers by means of the systematic breeding of the egg parasite *Trichogramma* sp. A preliminary account of this work is given in the article in question, and while it is as yet too early to express an opinion as to the probable success which may be achieved, the effort is worthy of notice.

Secondary Leaf-fall of Rubber.

Attention is invited to a short abstract to be found elsewhere in this number, of a report by Mr. Beeley of the Rubber Research Institute of Malaya on the general occurrence in the Southern half of the Peninsula of the fungus known as *Oidium Heveae* which causes secondary leaf-fall. With a view to determining the extent and spread of infection, this fungus has now been included as a notifiable pest in the schedule attached to the Pest Notification Rules 1925 under the Agricultural Pests Enactment and Ordinance No. 166 (Agricultural Pests).

Locusts.

On May 17th, 1930, a report was received from the Agricultural Field Officer, Negri Sembilan, that a somewhat small and scattered swarm of locusts had been found in a patch of lalang about 14 acres in extent situated about 2 miles from the Tampin Gemas road to the north of $7\frac{1}{2}$ mile stone. Comparison of these insects with specimens in the entomological collection of the Department and with published descriptions left little room for doubt that they were the same locusts, *Locusta migratvria,* which were present in large numbers in Selangor, Negri Sembilan, Malacca and Northern Johore during the years 1913 to 1918. Recent researches show that this insect normally lives as a solitary grasshopper, but that after a number of generations, individuals collect into small rather loosely gregarious swarms which in turn give rise to much larger and migratory swarms of true locusts. The insects found in Negri Sembilan are believed to be in the congregating phase which precedes the formation of large swarms. Consequently, it is important to destroy them in their present phase before their offspring have given rise to large and destructive swarms. There is a possibility that other similar swarms will assemble during the next few months in open grasslands, especially the less frequented 'lalang' grass areas near the Negri Sembilan—Malacca—Johore boundaries, and the Department is anxious to obtain reports of any swarms or suspected swarms of locusts that may be observed, so that measures can be employed promptly to destroy them.

ORIGINAL ARTICLES.

PEPPER IN MALAYA.

BY

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Introductory.

It is proposed in the following paper to present in a concise form, the main facts known regarding the cultivation of pepper, *Piper nigrum*, L. in this country. A considerable amount of information exists, scattered in various publications, since the production of pepper is closely associated with the early development of the older Settlements. The most complete account of this important spice is to be found in "Spices" by H. N. Ridley (1912), page 239. It is evident, however, that there are a number of important points regarding the behaviour and cultivation of pepper locally that require elucidation. It is hoped that more complete information will be available in the near future as the experimental cultivation of this crop is receiving the attention of the Department of Agriculture.

History.

The pepper plant appears to be indigenous to the Malabar Coast of Southern India. From early times, until the fifteenth century, the majority of pepper marketed was produced on the West Coast of India. The arrival of the Portuguese in India in 1498 resulted in the gradual spread of pepper cultivation to the islands of the Malay Archipelago and by the seventeenth century Malacca had become an important centre for the trade in this spice.

The introduction of the pepper plant into Penang is credited to Capt. Francis Light, who is stated to have obtained the plant from Sumatra in 1790. For the next decade pepper was the most important crop cultivated on the Island, but in 1802, when cloves and nutmegs were introduced from the Moluccas, less attention was given to it.

After the founding of Singapore about 1822, the cultivation of pepper was undertaken by Chinese, both in Singapore and Johore. Ridley states that the Chinese combined its cultivation with that of gambier until about 1894, when for several reasons the plantations gradually died out. In 1910, pepper was fairly extensively grown in Johore and then showed signs of increasing. This

Ripe Pepper Berries.
(*Piper nigrum*).

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expectation does not appear to have been realized, however, and is hardly to be wondered at considering the rapid strides of rubber planting by Chinese cultivators since that date.

During recent years very little pepper has been grown in the Malay Peninsula, though Singapore has been an important market for the spice. On the other hand, the pepper industry in certain other countries in the Malay Archipelago, notably the Netherlands East Indies and Sarawak, has been of considerable importance. In Sarawak, exports of this spice in 1906 amounted to 90,477 piculs (1 picul = 133⅓ lbs.) valued at $2,394,278 (Straits currency). After 1906, exports declined owing to the disease known as "Black Fruit" Disease of Pepper (*Cephaleuros mycoidea*), resulting in many pepper gardens being abandoned. In 1920, the exports of pepper had fallen to 18,031 piculs valued at $712,122.

The Local Market.

As already stated, Singapore, and to a lesser extent Penang, are important markets for the collection and export of pepper. The table on page 275 compiled from official returns shows the trade in this spice during the periods 1925—1929.

The following table gives the average prices for black and white pepper at Singapore for the period 1925—1929:—

TABLE I.

	Black.	White Sarawak.
	$ c.	$ c.
1925	31.08 per picul	51.26 per picul
1926	43.81 ,,	68.36 ,,
1927	53.77 ,,	91.10 ,,
1928	66.27 ,,	98.56 ,,
1929	57.88 ,,	103.73 ,,

1 picul = 133⅓ lbs.

Owing to the very marked increase in the value of pepper during the last few years, renewed interest has been taken in the possibilities of pepper production. The present Singapore market prices (May, 1930) are quoted as $50/- per picul for white pepper and $37/- for black pepper. This represents an increase in value of over 100 per cent. to the price ruling during the latter part of 1923. It must be appreciated, however, that the market for this spice is limited and increased production, as a result of the high prices ruling, are likely to cause a fall in values. It is a matter for conjecture as to what extent increased production will reach, having in mind the difficulty in obtaining suitable land in Malaya and the ravages of "Black Fruit" disease in Sarawak. It is evident that renewed interest in pepper cultivation is being taken in Ceylon and the West Coast of India.

TABLE II.

Imports and Exports of Pepper from Malaya.

Year	Imports.						Exports.					
	Black		White		Total Pepper		Black		White		Total Pepper	
	Tons	Value $	Tons	Value $	Tons	Value $	Tons	Value $	Tons	Value $	Tons	Value $
1925	8,767.25	4,401,866	5,255.71	4,851,741	14,022.96	9,253,607	7,338.01	3,426,196	8,210.30	6,561,877	15,548.31	9,988,073
1926	9,679.01	6,779,790	4,388.74	5,126,214	11,067.75	13,906,004	8,013.01	5,854,844	6,183.40	7,131,634	14,196.41	12,986,478
1927	6,139.28	5,781,855	5,572.43	9,020,193	11,721.71	14,802,048	6,376.51	5,892,836	6,897.83	10,597,938	13,274.34	16,490,774
1928	6,918	7,385,903	5,586	8,787,594	12,504	16,173,497	5,962	6,435,923	7,300	11,711,059	13,262	18,146,982
1929	7,341	7,474,383	6,397	10,418,832	13,738	17,893,215	5,656	5,537,532	7,009	11,928,970	12,665	17,466,502

Description.

Black pepper is the dried fruit of *Piper nigrum* L. belonging to the Natural Order *Piperaceae*. The plant is a large woody climber but under cultivation its growth is restricted. The flowering catkins are from 1 to 6 inches long and $\frac{1}{2}$ inch in diameter, each bearing about 60 pepper corns when mature. It is stated that in the wild forms the plant is unisexual, i.e., having male and female catkins on separate vines. In the cultivated plant, however, male and female flowers are usually produced in the same catkin. The berries are a dull green colour turning red as they ripen. Beneath the red skin is a thin layer of pulp which encloses the round white seed.

The vernacular names for this spice is "lada" Malay, and "molagu" Tamil.

Varieties.

Ridley states that the pepper cultivated in the Malay Peninsula is of one variety only. From recent observations made by the writer this appears to be true at the present time. Sumatra Malays, who cultivate this crop, appear to have no knowledge of distinguishable forms occurring locally. The local form produces hermaphrodite catkins, i.e., male and female flowers intermixed on the same spike, and for this reason are heavy fruiters. The fruits contain large seeds and yield white pepper corns of good quality.

Recognisable varieties are, however, recorded from Sumatra, Siam and the West Coast of India. These varieties differ in habit, shade requirements, fruiting season, size of spike and berry, and degree of pungency of the prepared pepper corn. It is not proposed in this paper to record the descriptions of these forms since a detailed study of the subject is desirable before a true idea of their value under local conditions may be obtained. Ridley refers to three varieties mentioned as occurring in Sumatra namely, "lada kawur", "lada manna", and "lada jambi". Trang pepper is grown in the Siamese State of that name. According to Bulletin No. 98, "Pepper Cultivation on the West Coast," published in 1929, by the Department of Agriculture, Madras, several varieties are cultivated on the West Coast of India. These are as follows:—Kalluvelli, Balankotta, Uthirankotta, and Cheriakoti. Of the first three varieties, Kalluvelli is shown as the best yielder. Sub-varieties occur, but these are mostly of inferior value.

Soils and Situation.

The pepper plant grows naturally in the decaying leaf-mould formed in forests. Under cultivation it will grow in a variety of soils but, where humus is absent, manuring with burnt earth or wood-ashes is essential to secure satisfactory results. It appears to thrive better on flat land than on the slopes of hills, probably owing to the fertility of flat land being less affected by erosion than in the case of sloping land. In the past, pepper has been grown successfully on stiff yellow clay soils in Malaya, but the fertility of the soil was maintained by continuous application of burnt earth and wood ashes.

Propagation.

Propagation of the pepper vine is usually undertaken from cuttings, though it may be raised from seed.

Cultivation from seed.—Detailed information regarding the behaviour of pepper raised from seed is not available. It is stated that in Ceylon at least eighteen months must elapse before seedlings are ready for removal from the seed nursery to the field (Department of Agriculture, Ceylon; Leaflet No. 53).

Seed collected locally and sown in boxes at the Experimental Plantation, Kuala Lumpur, gave 90 per cent. germination. In three months time from sowing, many of the seedlings reached a height of eight inches and were sufficiently large to plant out. When dealing with seedlings on a large scale in nursery beds it is probable that a greater length of time must be allowed before the young plants would be ready for removal. Ridley (l.c.) mentions two main objections to employing seedlings namely, the possibility of not coming true to type and length of time before vines commence to fruit. It is, therefore, desirable to employ cuttings in preference to seed when the former are available.

Cuttings.—Strong cuttings, 1 to 2 feet long, with lateral branches, taken from the upper part of bearing vines should be used. Smaller cuttings will grow but take longer to become established. Cuttings from the runners of the previous season's growth, growing from the base of the vines, are used in India. The base of the cutting should be cut clean below the node.

Since pepper cuttings are very liable to dry out if exposed to sunlight, care is necessary to keep them in fresh condition after they are removed from the parent vines.

The most satisfactory method of raising plants from cuttings is by planting them in nursery beds. Cuttings planted direct in the field, unless conditions are very favourable, frequently die or fail to grow for many months. Malay cultivators ordinarily place the cuttings in shallow trenches, covered with a coconut palm leaf, under the shade of fruit trees. The cuttings sprout in about three months and are then lifted during rainy weather. Nursery beds should be in a sheltered situation with good drainage. The ground is well dug and made into raised beds, and shaded with palm leaves, placed on poles, about 5 feet from the ground. In dry weather frequent watering is necessary, since the cuttings require a damp atmosphere.

Shade and Supports.

Pepper plants are either allowed to grow up living trees or else hard-wood posts are provided. The latter method is commonly undertaken in the Malay Archipelago.

In India and Ceylon, living standards are used. The most common trees planted being dadaps (*Erythrina indica* and *E. lithosperma*), kapok (*Ceiba pentandra*), Jack fruit, Mango and *Morinda tinctoria*. The tree selected for this purpose should be quick-growing, deep-rooting, able to withstand heavy

Mature Pepper Vine (*Piper nigrum*),
at Cheras, Selangor.

pruning, and, preferably leguminous. When dadaps are used they are generally planted about 7 feet apart. The use of living trees as supports in Malaya is not recommended. More satisfactory results are obtained by using stout hardwood posts. The posts should not be less than 6 inches through and about 14 feet long, thus allowing 10 feet above the soil. The spacing allowed between the posts is usually from 6 to 7 feet.

In the Netherlands East Indies, where special attention is given to the crops, stone pillars are sometimes used as supports.

It is obvious that the supply of suitable supports is a necessary concomitant to the successful cultivation of pepper on a large scale.

Though the pepper plant occurs wild in dense jungle, under cultivation shade is not essential and is not employed in the pepper gardens of Sarawak and Sumatra. During the early stages of the plant's growth, a few trees in the vicinity of the pepper garden appear advantageous, but the plants are quite amenable to full sunshine in the humid atmosphere of Malaya.

Cultivation.

When the cuttings are ready for transplanting, they are lifted from the nursery beds and planted a few inches away from the supports, facing east. Several cuttings may be planted against each support. Planting should be undertaken during damp or rainy weather and the young plants shaded from the sun by fern fronds or branches of trees. As the vine ascends, it is tied to the post with twine and on reaching the top, it is usually pulled down and wound round the base of the support. Periodical pruning is necessary to prevent the plant from growing bushy at the top. When the vine is a year old, heavy pruning is often undertaken and the cuttings employed as further stock. The object of the cultivation is to promote branching so that the upper plant covers the support with a dense mass of stems and fruiting branches. The vine takes from three to four years to cover the post, and may then be considered full grown. During this period, pruning, removal of early flower spikes, weeding and manuring is undertaken.

Manuring.

Various forms of manuring are employed by native cultivators, principally the use of burnt earth and wood-ashes, and dried fish refuse. The use of burnt earth as a manure for pepper was commonly practised in the Straits Settlements in the past and is considered of primary importance in the cultivation of this crop in Sarawak. Bushes, branches of trees and other vegetable matter are collected and heaped and partially sun-dried. Soil is then added until the whole forms a large heap. The wood is then ignited and the heap allowed to burn. The resulting burnt earth and wood-ashes are then applied to the base of the pepper plant several times during the year. It appears evident that the potash salts derived from the burnt vegetation forms a suitable food supply to the pepper vine. The use of artificial manures, rich in potash, might prove success-

ful in pepper cultivation and merits trial. On the West Coast of India, fish guano at the rate of ¼ to 1 lb. per vine, and 1 lb. of lime mixed with 20 lbs. of leaf-mould per vine, is recommended (Bulletin No. 98, Agricultural Department, Madras).

Yields.

The vines commence fruiting as early as a year after planting, but fruits should not be allowed to develop until the plant is fully grown, which will be about the third or fourth year after planting. There are generally two crops per annum, one in August/September and the other in March/April, but cropping often continues throughout the year. The vines are considered to be in full bearing at the seventh year and under favourable conditions, will continue to yield good crops for 12 to 15 years.

During the first cropping year, a yield of about 1 lb. of dry pepper per vine is obtained. After the seventh year, an annual yield of 3 to 3½ lbs. of dry pepper per vine is obtained which, with 880 vines to the acre, approximates to 2,500 to 3,000 lbs. of dry pepper per acre per annum.

Preparation.

The fruits turn yellow and finally red when ripe. After a few berries have ripened the whole spike may be plucked. The berries are detached from the spikes by beating with short sticks or rubbed off by hand.

Black pepper consists of the ground whole, dried berries, i.e. the undecorticated fruit. This form of pepper is obtained by simply drying the berries on mats in the sun. The quality of the pepper can be improved considerably by plunging the berries into boiling water for 10 minutes before drying. Boiling results in the skin of the berries turning black rapidly and accelerates the drying process which is complete in 3—4 days. When large quantities of berries are dealt with, drying rooms with artificial heat are employed.

White pepper consists of the fully ripened berries, deprived of their black skin before grinding. The skins are removed by softening the pulpy covering. This is done by keeping the berries in moist heaps or in sacks in running water. The stalks and pulp are separated by washing in baskets. The pepper corns are then removed and placed on mats to dry in the sun.

Disease.

A serious disease of pepper berries, known as "Black Fruit" caused by the parasitic alga, *Cephaleuros mycoidea*, has resulted in very serious losses to pepper cultivation in Sarawak. A report on this subject was published in the "Malayan Agricultural Journal," Vol. XI, page 120, as a result of a visit to Sarawak in 1922, by the Mycologist of the Department of Agriculture, S.S. & F.M.S. The disease, however, appears to be the result of abandoned cultivation and is less likely to be of serious consideration where judicious cultural methods are undertaken. The possibility of the disease occurring on pepper in Malaya must not, however, be overlooked.

BALED COPRA.

BY

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Introduction.

The usual method of packing copra is to suspend an open sack from the roof of the copra store and to compress the contents by means of heavy poles used as rams. By this method, two coolies can fill ten bags, each containing a picul of copra in one hour. For shipment to Europe, new bags costing 50 cents each are frequently employed, having a capacity of between 133 lbs. and 2 cwts., while second-hand bags are almost invariably used for the local sale of copra.

The Proposal to Bale Copra.

It has been suggested that the effective space, occupied on ships and in godowns by a ton of copra, can be reduced, and pilferage controlled by packing well-dried, good quality copra in the form of compressed, oblong blocks of uniform size and shape, and weighing two cwts. each. Such bales can be handled, stacked and checked easily and well, and, provided that the moisture content of the material was less than 7%, resistance to mould growth, to the development of acid and rancidity and to insect attack would possibly be greater, than when copra is packed in sacks.

Description of Plant and Process.

As is the usual practice with "mixed" copra for export, the copra is first sorted to remove bad pieces of "F.M." (fair-merchantable) quality. The good copra of F.M.S. (fair-merchantable-sundried) quality is chopped by women to give eight pieces per nut. This sizing which assists compression of the bale and ensures a cohesive block, could alternatively be done in a turnip cutter.

The practice of chopping after drying is already practised on some estates, and serves to ensure a product of uniform and convenient size; to improve the

appearance of the copra; to prevent the accidental inclusion of dirt, foreign matter and pieces of second quality copra; to assist further drying; and also to ensure that the copra makes a close and tight pack. On the other hand it might be better to chop the copra in the half dried condition, when it is being removed from the shell; if this is done, the cut surfaces will seal up in later stages of drying and the rate of drying will be further accelerated and more uniform drying assured.

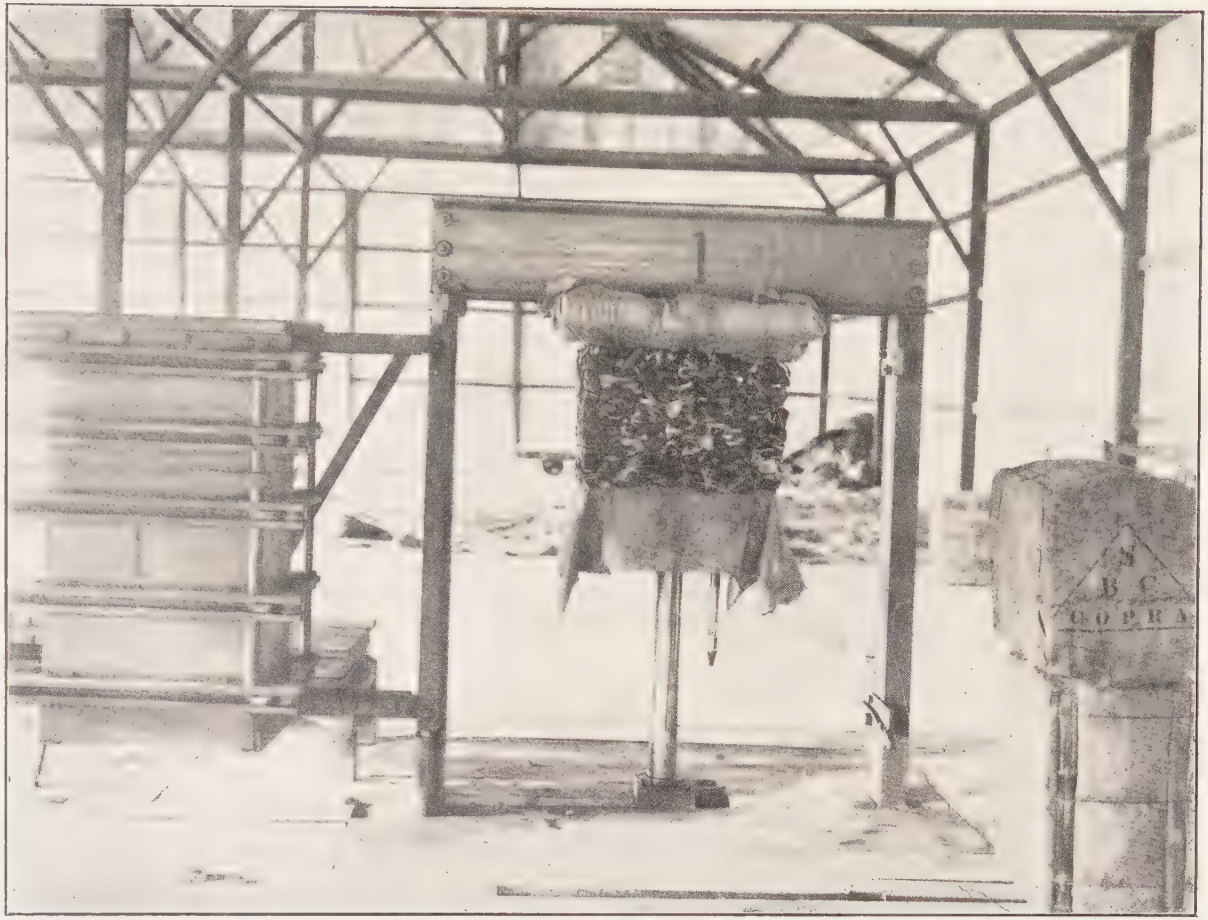
The following is a description of a baling press which is in operation in Selangor:—

The baling machine consists essentially of a long steel box, 4′ high, with two fixed sides and two hinged sides, and capable of being swung as a whole on a vertical shaft. All the sides are reinforced by strengthening girders, and secured in position by a rapid acting clamping device. The top and bottom of this box consists of two removable, grooved, wooden plates or "platens", strengthened and backed with steel, and making a close, sliding fit with the vertical sides. These "platens" are removed from the machine, and two new pieces of Hessian cloth (40″ × 48″) which will ultimately cover the bale are laid over them, and secured in position. The top "platen" is then fitted to the underside of a stout cross-arm, supported on two vertical joists immediately over the hydraulic ram-head; and the bottom plate is placed in position in a recess at the bottom of the box which is thereupon closed securely by the clamps.

The power to work the hydraulic ram is obtained from a 10 h.p. Tangye engine through a counter shaft, the pressure being applied and controlled by a simple arrangement of levers.

Two cwts. of the chopped copra are emptied into the box and levelled up. The filled box is then swung smoothly into position over the ram head and immediately under the top "platen" suspended from the cross arm. A pressure of 28 tons is slowly applied, until the copra ceases to compress, through the ram head to the underside of the lower platen, the area of which is 384 sq. inches. The effective pressure on the copra during a compression period lasting 40 seconds, is thus 1.5 cwts. per square inch.

When the limit of compression at this pressure has been reached, the ram is locked in this top position, and the clamps securing the box quickly released. The whole cage then swings clear of the bale, back to its original position, where it is recharged. The bale remains held in position between the two "platens" by the locked ram head, and the copra is thus exposed to view, a solid oblong block, with not a trace of oil exuding from it. The Hessian cloths are loosened from the "platens", and roughly "stabbed" into position over the block of copra. Three "Safe-seal" wires are next passed through the grooves in the "platens" so as to encircle the bale and they are separately tightened and sealed by a portable "Griplock" sealing machine. The ram is now released, and the bale trucked away for sewing.



Copra Baling Press.

Working Details.

	Baling Process	Bagging Process.
Maximum throughput of Process -	17 bales per hour or 34 cwts. per hour	10 bags per hour or 12 cwts. per hour.
Time for one complete bale or bag	6 minutes	6 minutes
Weight of packing -	4 lbs to 2 cwts of copra	2 lbs to 1 picul of copra equivalent to 4 lbs to $2\frac{1}{3}$ cwts.
Cost of packing materials -	45 cents a bale or 23 cents a cwt.	50 cents a bag or 38 cents a cwt.
Pressure applied at ram -	= 28 tons	
Pressure on the bale -	= 1.5 cwts. per square inch	

It is not possible to give details of the labour requirements until the present plant is on a full-time regular production.

The Bale.

The finished bale is a very neat oblong block of a convenient size and shape to handle. Four pieces of split bamboo which are inserted with the Hessian cloth under the wires, serve to keep the bale rigid and compact, and prevent the wire cutting into the copra and so loosening during the vibrations of transport.

The volume occupied by the two cwts. of baled copra is under 5.3 cubic feet, as against 8.3 cubic feet for the same weight of copra in sacks, and the overall dimensions of the bale are $25\frac{1}{4}'' \times 17'' \times 21''$.

The bales pack very neatly and squarely; 84 bales arranged in a stack, 7 high, 4 wide and 3 deep, occupy 49 cubic feet ($12'\ 7'' \times 9'\ 3'' \times 4'\ 2''$). Thus the "broken stowage" for 100 bales (10 tons 4 cwts. in weight with packing) will be 58 cubic feet. At present, because it is a bulky commodity, 12 cwts. of bagged copra are charged freight, as though they weighed a ton, whereas if the copra were baled, a ton of copra could be freighted as such without correction, and 8 cwts. stowage could be saved.

Possible Oil Loss during Baling and Shipment.

(a) By compression.—Although the pressure is gradually applied to the loose copra and is only of 40 seconds duration, it might be thought that oil would be lost. There is however no sign of loss of oil, nor darkening of the floor immediately underneath the press, and if the hand is rubbed over the exposed block of compressed copra, it will be found to show no trace of exuded oil.

The bale of copra is wired and left in compression, so that the pressure is maintained, until the block is broken up. It could be argued, therefore, that the vibrations and shocks of transport might cause oil to exude and be absorbed in the Hessian covering material. There is, however, no loss of oil on this account.

(b) By self-heating.—In a single bale of copra, the facilities for heat escape may be worse than from the centre of a bag of loose copra. It is almost certain however that a stack of bales is better ventilated than a stack of bags because of the straight channels and connected air gaps which must separate each bale and allow free passage of the cooling air. In a heap of bags, the air spaces which exist inside are generally sealed at some point by the weight of superimposed copra.

When copra deteriorates, heat is liberated and, under the conditions existing in a stack of sacks in the hold of a ship, is accumulated to the further deteriment of the copra and the production of free acidity, moisture, colour and rancidity with loss of oil.

It will be seen, later, that in the trial shipment of good baled copra, no oil loss whatsoever has occurred, and that the free acid formation is somewhat less than the average for sacked Malayan copra of good quality.

Control Analyses of a Trial Shipment of Copra.

A small quantity of copra was taken from each bagful of a large consignment of copra, prior to baling. This total sample, weighing about 360 lbs., was then well mixed, spread evenly on the floor, and the pile divided into four quarters. The copra from two diagonally opposite quarters was taken for pressing into a sample control bale, to be kept in the store shed of the Department of Agriculture, and the copra of the remaining two quarters was then "quartered down" until only 10 lbs. was left. From this small amount, three samples were drawn for determination of the percentages of moisture and oil in the copra, and of the acidity of the cold expressed oil. The loose copra still remaining was then placed in a sack and stored under the same conditions as the control bale. The results of the analysis, and the appearance of the copra indicate that the copra was of normal good F.M.S. quality.

Analysis prior to Despatch.

Test.	Sample No. 1.	Sample No. 2.	Sample No. 3.	Average.
Moisture *o/o* ...	6.8	6.7	6.7	6.8
Oil *o/o* (wet basis, copra as received) ...	60.1	60.9	60.6	60.6
Oil *o/o* (dry basis) ...	64.6	65.3	65.0	65.0
Acidity *o/o* (as lauric acid)	.65	.74	...	.70

The main consignment of bales was despatched to Europe and two months later the control bale and sack of copra stored at the Department of Agriculture were reweighed and tested with the following results:—

Analysis after Two Months.

Loss in weight

Pack.	Nett weight June 25th.	Nett weight August 27th.	% loss in weight.
Bale -	229	224	2.2
Sack -	113	111½	1.3

Acidity of the cold expressed oil (as lauric acid)

Sample taken from	Date	Acidity *o/o*	
Loose copra before baling -	June 27th	--	.70
Copra from centre of bale -	—	1.72	Av. 1.44
Copra from outside of bale -	Aug. 25th	1.16	
Copra from sack -	Aug. 27th		1.13

There was little evidence in either case of mould growth, although in both cases the copra had been attacked by a variety of insects. The stored bale shewed no signs of oil exudation, nor were there any indications of the copra

becoming self-heated by deterioration in the absence of freely moving cooling air within the bale.

The main consignment of this copra, despatched to Europe in baled form, arrived at its destination in August, where it was analysed both by the consignees (C) and also by an independent arbitrator (A).

Comparative Record of Analyses.

Total Oil Content—before and after shipment.

	Weight in cwts.	Oil o/o (wet basis)	Total Oil cwts.
Loose copra before baling ...	1904¾	60.6	1152
The same copra as (C) ... received in baled	1845¾	62.8	1158
form in Europe (A) ...	1845¾	64.0	1180

Quality.

Sample taken from :—	Moisture o/o	Oil o/o (dry basis)	Acidity. o/o
Loose copra before baling ...	6.8	65.0	.70
Stored in Malaya—baled ...	—	—	1.44
sacked ...	—	—	1.43
Baled copra as delivered (C) ...	4.5	65.8	1.51
(A) ...	4.6	67.2	1.48

% Loss in weight in two months.

Circumstances.	Loss in weight o/o
During storage in Malaya—as a single bale ...	2.1
—as a single sack ...	1.3
During shipment to Europe in baled form ...	3.0

From the above it will be seen that the copra does not lose oil during baling, or subsequently during shipment and storage. The slight differences in the calculated amount of total oil are within the limits of experimental error if consideration is allowed for possible differences of method, and for personal error.

The acidity of the oil was determined here on the cold expressed oil and not on the oil extracted by solvents, the latter giving slightly lower results. It would appear that in spite of the cooler conditions on the way to Europe, the stacked bales deteriorated slightly more than the solitary control bale kept at the Department of Agriculture, whilst the loss in weight was also greater, though, of course, the conditions of storage were very dissimilar.

The deterioration of Straits F.M.S. copra during shipment in sacks to Europe.

Eighteen large samples of F.M.S. copra from various estates in Malaya gave the following results on analysis:—

Moisture *o/o*			Oil *o/o* (Dry basis)			Acidity *o/o*		
Av.	Max.	Min.	Av.	Max.	Min.	Av.	Max.	Min.
6.9	9.1	4.7	65.9	69.0	62.2	.18	1.00	.03

Seventeen different bulk consignments of Straits F.M.S. Copra, received in Europe in sacks, yielded the following figures from the analyses of the consignees:—

Moisture *o/o*			Oil % (Dry basis)			Acidity *o/o*		
Av.	Max.	Min.	Av.	Max.	Min.	Av.	Max.	Min.
4.7	5.5	3.9	65.0	67.0	63.6	2.25	5.06	.35

It will be seen that the average acidity has increased from .18% to 2.25% for copra in sacks, whereas the trial shipment of baled copra only increased in acidity from .7% to 1.5%. The loss of moisture for copra in bales and in sacks is however identical.

Conclusions.

1. There is no indication of loss of oil during or after baling when the copra is properly dried, is of genuine F.M.S. quality, and is packed cold.

2. There is no evidence that the copra deteriorates more when in the form of compressed blocks, than it does when stored in sacks, in fact there are indications to the contrary.

3. The system of chopping before baling will ensure a product of uniform and convenient size which will be easy to handle by the crushers, and will also prevent the accidental inclusion of dirt and foreign matter by the producer.

4. Baled copra is convenient for handling, stacking, and checking.

5. The trial shipment arrived in Europe "intact and in good order".

6. The effective space occupied by copra in baled form is one third less than when stacked in sacks.

In conclusion, the writers wish to record their thanks to Mr. F. W. Douglas for technical assistance in this inquiry; also to Mr. Gunn Lay Teik for carrying out the analytical work.

The dollars quoted in this article are Straits Settlements currency $\$1 = 100$ cents $= 2s.\ 4d.$

Also 1 picul = 100 katis = $133\frac{1}{3}$ lbs.

For explanation of the significance of oil % (wet basis) and oil % (dry basis) see *Malayan Agricultural Journal* Vol. XVII—September 1929, No. 9.

INSECT PESTS OF PADI IN MALAYA.

BY

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Wherever padi is cultivated it is attacked in various ways by many kinds of insects, some of which are responsible for a heavy annual loss to cultivators. Others are occasional pests, individually unimportant, but, when appearing in great numbers, capable of causing serious damage.

In Malaya, seventy-four species of insects have been recorded on padi. This information is based on the list included in a bulletin published by this Department in 1926 (1) and on records compiled by the Entomological Division up to the present time.

The following notes thereon, together with details of the habits and descriptions of some of the more important pests which cultivators have to contend with, are now put forward for general information.

The Orders in which the more important padi insects occur are the Rhynchota or bugs and the Lepidoptera or butterflies and moths.

Four species of Rhynchota may do appreciable damage to the padi crop, and a fifth species—*Tetroda histeroides*—, a black insect, elliptical in shape, having the front part of the head bifurcate, and the sides of the anterior margin of the thorax produced forwards, has been recorded as a serious pest of padi in South India (2). It is about five-eighths of an inch in length.

Of the other four, *Scotinophara coarctata* (Mal. Kutu běruang, běna kura) is frequently a serious pest in Pahang and along the Perak River in dry years, but is capable of being controlled, provided adequate water is available for flooding the fields.

S. coarctata is similar in colour to *T. histeroides*, but is about half the size and has no parts of the head or thorax produced. In all stages, it attacks the plant low down.

The life history of this species has been dealt with (3).

Leptocorisa acuta (Mal. Pianggang, Kěsing, Chěnangau) an elongate greenish brown insect with long and slender antennae and legs, feeds on the ripening grains and causes them to turn white, when entirely sucked out, and blackish when partially sucked.

The body is five-eighths of an inch in length.

Sogata pallescens a very small "bug" about one sixteenth of an inch in length, dirty white in colour with the forewings not thickened in the basal half, has, on more than one occasion, caused damage in Province Wellesley and Krian. It is known among the Malays as běna or běna puteh, which also include *Sogata distincta.*

The areas attacked can be readily picked out in the field, for the plants are distinctly yellow, and as the insect appears never to miss a plant, the affected area is distinctly demarcated. The eggs are laid at the mid-rib of the leaf blade, and the part turns reddish brown afterwards. The female inserts her eggs under the cuticle by making a longitudinal slit which is oblique to the surface of the leaf.

The eggs are spindle shaped. Two days after oviposition the part of the leaf turns brown and three days after that the incubation is completed.

Leaves examined in the laboratory for eggs of *Sogata* revealed the presence of numerous mites, which may be instrumental in suppressing outbreaks. The mites appeared to be of two forms differing considerably in appearance, but it is believed they may be stages of the same species.

The first immature stages, more properly called the first stage nymphs of *Sogata* are greyish green just after hatching. After two days, however, the nymph is light grey with dark grey patches on the thorax and abdomen. The legs are greyish and the under surface of the body pale cream colour.

They appear to feed mainly on the leaf blade, but a few have been observed to attack the leaf-sheath fairly low down on the plant. Some first stage nymphs are covered with white wax-like scales.

The favourite site of feeding of the adults appears to be just above water level, the insects attacking the leaf-sheath at this point, but both older nymphs and adults have been observed on leaf blades as well.

When the plants are disturbed, all stages of the insects jump off on to the water and make their way to neighbouring plants. The adults when submerged for a few minutes remain quiescent in most cases and appear to suffer no ill effects, nor are they wetted.

It has been found that an outbreak may be suppressed by draining off the water for about two days, when fresh water may be run on if required.

It is said that the water in badly attacked areas is malodorous, and it is this which led to the draining of the water, and to the subsequent discovery that the pest then disappeared. This practice has been carried out on several occasions in more than one place with similar results.

The Lepidoptera are represented by six identified species, of which three feed on the leaves and three bore inside the stem. The latter are the more important and frequently occasion considerable loss to the rice growers. Affected plants are conspicuous in the latter stages of attack, having the leaves, particularly the centre ones, brown and withered.

Stem borers are collectively known to the Malays as "ulat batang padi" and also "ulat kisar".

The three identified stem borers are *Diatraea auricilia*, *Schoenobius incertellus* and *Sesamia inferens*.

The eggs of the first named are laid in masses on the upper or under surface of the leaf blade. Between thirty and two hundred eggs have been counted in a mass. They are white at first, turning to yellowish grey, finally to black and are arranged irregularly and overlapping each other.

The caterpillar is whitish with irregular brownish interrupted stripes which run lengthwise. It makes no cocoon before it changes to a pupa.

The adult male is brownish yellow with some metallic spots on the forewings and with brownish white hindwings. The female is similar but larger. The metallic spots are smaller and the ground colour of the forewings is pale yellowish.

The male measures 18 mm. and the female 25—27 mm. across the forewings.

S. incertellus lays her eggs also in a mass on the leaf blade. The mass is covered with brownish scales. The caterpillars are somewhat variable in colour, ranging from almost white, through pale green to a dark dirty greenish grey. A cocoon of whitish silk is formed and this has a silken tube connecting it with the exit hole.

The adult male moth has brownish yellow forewings with a small central black spot; it measures 18—22 mm. The female has brownish forewings and pale smoky hindwings. The wing expanse is 34 mm.

The part of the padi plant chosen by the female of *Sesamia inferens* for depositing her eggs, is beneath the leaf-sheath, where she lays several rows in a mass.

The eggs are creamy-white when first laid, turning to flesh-pink on the second day. In shape they are hemispherical and are finely fluted on the sides.

The caterpillar is whitish with a pink tinge, and a chestnut brown head. A loose web of silk is formed, usually outside the stem, by the caterpillar.

The adult moth has pale bright fawn colour forewings with one or two suffused brownish stripes and whitish hindwings.

All these species can live as caterpillars in submerged stems, apparently being unaffected by the water in which they remain immersed. They frequently cause the early death of a plant by completely ringing the node at the point of entry before complete penetration of the stem occurs. Having done this it is not unusual for them to leave the stem and attack another.

A special campaign against the stem borers was instituted in 1929 following a severe outbreak in the Krian district.

Control of *Diatraea auricilia* and *Schoenobius incertellus* by means of parasites of the eggs was considered to be the only method likely to succeed, since the cultural methods of control which are advocated and are carried out in other rice growing countries would not, it was thought, be carried out with any measure of zeal or enthusiasm by the padi cultivators of Malaya.

It may be mentioned that the eggs of *Sesamia inferens* are practically immune from the attacks of parasites owing to their location on the padi plant.

In the present state of our knowledge, it is believed that *S. inferens* is not such an important pest of padi as the other two species of stem borers, but, should it prove to be so, other measures will have to be adopted for its control.

The caterpillars of *Nymphula depunctalis* eat a portion of the leaf and folding it, make a shelter in which they move about on the plant and on the

surface of the water. They are known as "ulat apong" and may do considerable damage in nursery beds. The caterpillar is light green with darker green longitudinal stripes and a light brown head spotted with dark brown.

The two army worms *Spodoptera mauritia* and *Spodoptera pecten* are leaf feeders, but being conspicuous they may be readily dealt with before the damage attains any magnitude.

The eggs of these two species are deposited in the leaves and are covered with scales from the abdomen of the female. The caterpillars are greenish-brown in colour with dark brown diagonal spots, and when full grown measure about 3 cm. in length. There is a certain similarity in appearance of the adults of *S. mauritia* and *S. pecten,* both having brownish forewings with whitish and dark brown irregular markings, and pearly white hindwings.

References.

1. A Preliminary List of Foodplants of Some Malayan Insects, Bulletin No. 38, Department of Agriculture, F.M.S. & S.S., 1926. Corbett & Gater.
2. A New Pest of Rice in South India. Bulletin of Entomological Research, Vol. XX, pt. 2, August, 1929. P. N. Krishna Ayar.
3. *Scotinophara coarctata,* F. (The Black Bug of Padi) Malayan Agricultural Journal, Vol. XII, April, 1924, No. 4. Corbett & Mohamed Yusope.

PINEAPPLE CANNING.

BY

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Factory methods for canning pineapples vary considerably between Malaya and the other countries of production, notably Hawaii. In the latter country, machinery is used as much as possible, whereas in Malaya, owing to its relative cheapness, hand labour is employed for almost all the operations. It is a curious fact that while in Hawaii the cans are purchased from a central can-making factory, in Malaya, each factory is equipped with a complete canmaking machinery.

A further marked difference between these two countries is that in Malaya the factories are generally established in close proximity to the pineapple plantations. The most distant are the five factories in Singapore, which draw the bulk of their supplies of fruit from Johore—a matter of perhaps 30—50 miles by road. The nearest to the centres of production are in Johore where there are twelve factories, situated so close to the fields that transport is reduced to a minimum. The principal factories in Hawaii and Africa may be situated a considerable distance from the plantations. The nearest plantation to the largest Hawaiian factory is twenty-five miles distant. The Port Elizabeth factory is 125 miles from the estate, the latter being intersected by over 150 miles of roads.

The fact that by the Malayan method, transport both of fruit and empty cans is reduced to a minimum, has its advantages. The fruit can be harvested in a riper condition than would otherwise be possible, while the factory methods are such that generous use is made of labour—which is comparatively cheap; while freight—which is comparatively expensive, is reduced to a minimum.

The question of power must also be considered in connection with situation and size of factory. In Hawaii, electricity is used at a cost of from 2—4 cents (gold) per kilowat. In Malaya, the power required for a factory of 1,000—1,500 cases per day can be supplied by an engine of 15—20 h.p.

Capacity of Factory.

Factories in Hawaii are capable of turning out 1,500 cases per day; one factory is said to have a capacity of 4,000 cases a day. The largest output by a factory at Port Elizabeth, South Africa, is stated to be 2,300 cases per day. From a consideration of the number of factories working, the methods employed, and the total quantity of canned pineapples exported, it is evident that the

average capacity of a Malayan factory is lower than that of Hawaii or Port Elizabeth. Probably from 1,000 to 1,500 cases per day is the utmost limit of our local factories, while the capacity of the majority is even less.

Cost of Factory.

According to an Hawaiian authority, the cost of machinery, (excluding the cost of the buildings) capable of producing 1,500 cases per day, would be the equivalent of about $90,000 (Straits Currency). An important pineapple packer in Malaya published a statement in 1927 that "about $150,000 capital is necessary for an ordinary pineapple factory and for a factory of bigger capacity $300,000 will have to be invested". These figures, obviously, include working capital. The machinery in a Malayan factory with a capacity of 1,000 cases a day may be between $13,000 and $20,000 excluding shafting, power and cost of building.

The following details of factory methods refer to Hawaii and South Africa. The Malayan methods are so different, that they will be stated subsequently.

Can Making.

Hawaiian canners do not manufacture their own cans, but purchase them at $28 (gold) per 1000 from a can-making factory. A similar system is employed in Formosa, where the areas under the crop are somewhat scattered.* The Port Elizabeth factory manufactures its own cans with a plant capable of producing 30,000 to 35,000 cans daily.

A machine cuts the tin-plate to the requisite size for the body of the can. Flanges are then cut at each end of the body section to make the hooks or edges which will interlock to form the two side seams. It is then rolled to a cylinderical shape, double seamed interlocked and automatically soldered. The bottoms and tops are cut out and shaped by a press, the bottom being then fixed on by a seaming machine. Rubber solution (in Malaya, a thin band of rubber, locally manufactured) is applied in a groove on the outer edge of each disc; this renders the use of solder unnecessary and ensures that the cans are airtight.

Peeling, Coring and Sizing.

The "Ginaca" machine automatically performs the operations of peeling, coring and sizing. It is made in three sizes; viz., No. 2½, No. 2, No. 1. It has the disadvantage that it will only prepare fruit of one size diameter and cannot be adjusted to fruits of different sizes. The 2½ "Ginaca" will handle

* The pineapple canning industry in Formosa is relatively small, but is rapidly increasing.

about 38 pines per minute. It is made by the Hawaiian Pineapple Company and costs $5,900 (Gold).

In the operation, the pines climb a chain conveyor and are placed in position. The machine then cuts off the skin in two pieces, cuts off the top and bottom, extracts the fruit still adhering to the skin, then cores the pine.

The fruit is then conveyed to a trimming table, where any irregularities are rectified by hand.

A slicer is then employed, also made by the Hawaiian Pineapple Company, costing $2,000 (Gold), which cuts the fruit into slices about half an inch thick.

Canning.

The fruit is graded as it proceeds along a conveyor. The usual method is for certain of the workers to be responsible for picking out the best for "fancy" quality, others being responsible for standard quality—the remainder being broken pieces.

The broken pieces are conveyed to vats where they are broken up and boiled, becoming crushed or grated and packed in cans for special markets.

Cans containing slices are taken to a vacuum machine, costing $1,800 (gold), which removes most of the air, and thence to the Syruping Machine ($1,100 gold) which fills them with sugar syrup and thence to the Exhaust Box, a steam chamber, where they remain for six minutes at a temperature of 210°F.

The Double Seamer ($2,500 gold) places the lid in position, bends the edges down and under, after which a second machine flattens them hard in this position.

The cans are then sterilised for seven minutes at a temperature of about 222°F., and placed in a Lacquer Bath ($250) which improves the appearance of the can and is said also to retain the can in an airtight condition.

Subsequently the cans of fruit are dried and stored until labels are affixed.

Syruping.

The syrup with which the cans are filled is prepared with cane sugar and water, pineapple juice not being employed in its preparation. O'Conner reporting on the South African product states:—

> "Different syrups are used according to the variety of grade of fruit canned. As the 'Giant' or 'Cayenne' pineapple is less sweet than the 'Queen' variety, more sugar is used in preparing the syrup in which it is preserved".

The following is the percentage of sugar used:

For Queen Pines, 1st Grade fruit 27% sugar
For Queen Pines, 2nd Grade fruit 16% sugar

For Cayenne 1st Grade fruit 40% sugar
For Cayenne 2nd Grade fruit 30% sugar

Under the Canadian regulations affecting the importation of canned pineapples, the following are laid down respecting syrup.

"Heavy Syrup" for pineapple will be considered as that syrup which cuts out not less than 23 per cent Balling at 60°F.

"Light Syrup" for pineapples will be considered as that syrup which cuts out not less than 17 per cent Balling at 60°F.

Malayan Factory Methods.

The operation of peeling and cutting or slicing are always performed by hand. Grading is performed by the worker during these operations.

The following machinery is usually employed in a Malayan pineapple canning factory.

Foot Shears, for cutting the tin-plate into strips. Cost varies from $300 to $500 (Straits Currency). Two such machines are necessary in a factory having a capacity of 1000 cases per day. Each machine can be worked by one man.

Roller Shears, for cutting the body strips for 1½lb. flat size. The machine will cut six strips at a time. One such machine required: cost about $1,000.

A locally made hand machine, costing about $25 each is employed for rolling the body pieces. From five to ten machines of this description are used in a factory.

The edges of the body pieces are then notched by hand with a pair of scissors.

Soldering. Lap-soldering of the body pieces in cylindrical form is performed by hand. The usual contract price for this work is 11 cents per 48 cans.

Automatic Boardering Machine, prepares top and bottom edges for double seaming. Two such machines, costing about $500 each, each with a capacity of 3000—4000 cans per hour are used. Each machine can be worked by one man.

Punching Press, for cutting tops and bottoms: three or four such machines employed at a cost of about $900 each. The dyes of different sizes for these presses are locally made and cost from $100—$200 each according to size.

Double Seamers. For seaming bottoms to body. Cost $700 each. Two machines of this description are used for the bottoms„ and another two for the lids. Capacity, about 1500 per hour for each machine.

Grades.

Malayan pineapples are packed in three grades viz. Special Golden, Good Average Quality (G.A.Q.) and Number 3. No. 2, now less frequently pre-

pared, finds a market in China. The popular description is cube, although slices and whole pines are prepared for special markets. Several descriptions of shapes of tin and weights of content are marketed, although the tendency recently has been to reduce the number. A case of pineapples may contain 48 cans of 1½ lb. each, a case of 2 lb. cans may contain 24 or 36 cans according to whether the packing is of whole pines or slices, while the packing of 2½ lb. cans invariably has 24 cans to a case.

In Hawaii, the 'sliced' is packed in two grades, 'fancy' and 'Standard' and apart from 'Crushed and Grated' and one or two Special packings, only round cut sliced is made.

By-Products.

Only about one-third by weight of the pineapples received in the factory is utilised. In Malaya, no use is made of the waste from the factory. Greenstreet and Gunn Lay Teik* shew that for the economic disposal of the waste, the removal of the juice is essential. They describe remunerative methods of disposal of the partially dried waste, and also shew that the fermentation and distillation of the fresh juice for the production of a potable alcoholic liquor similar to brandy is a simple process. As far as the present writer is aware, no factory in Malaya has commercialised these results.

Cost of Canning.

It is stated that canned pineapples can be produced in Hawaii at £20 per ton delivered to the consumer, the factory cost being about $1.50 (gold) per dozen cans.

The African costs are said to be £5 per ton for fruit, and £5 per ton for cost of manufacture.

In 1927, a Malayan pineapple packer published the following statement of the factory costs per case of 72 lbs.

16 sheets of tin plate	...	$1.65
Lead and soldering	...	0.10
Good White Sugar	...	0.80
One empty wooden case	...	0.50
Labour	...	0.40
Water and fire wood	...	0.20
Rubber stripping	...	0.10
General expense of the factory	...	0.75

a total of $4.50 per case of 72 lbs. to which must be added the cost of the pines (80 medium quality pines per case, costing from 1—2 cents each). The total cost per ton on this computation would be $186/- or approximately £22

* "Bye Products of the Pineapple Canning Industry" by V. R. Greenstreet and Gunn Lay Teik. *Malayan Agricultural Journal.* Vol. XVI. No. 1. January 1928.

per ton. In view of the fact that the price of canned pineapples in Singapore is below this figure, it must be supposed that packers have been able to reduce their costs of production. In any case, the above statements of costs in different countries must be taken, at best, as only a rough approximation.

In conclusion, the writer has tried to shew that the Malayan pineapple canner has endeavoured to establish a market for a cheap but good quality product. This has been made possible by the following means; employing cheap labour, treating pineapples as a catch crop, placing the factories near centres of production, and producing a less elaborate and unlacquered can. The market now established, the quality of the product has been improved, and there would appear scope for further extension of the industry.

In the preparation of the above article, the writer is indebted for considerable assistance from the following sources: Notes on the Pineapple Industry in Hawaii, from a private source; The Pineapple Industry in South Africa from a Report by Mr. C. A. O'Conner of the Mauritius Department of Agriculture; Mr. P. T. B. Hansen of Singapore; The Empire Marketing Board Reports; and data collected from time to time by various officers of the Department of Agriculture, S.S. & F.M.S.

PEAT AS A FERTILISER.

BY

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In view of the interest recently aroused as the result of proposals for the economic utilisation of local peat deposits by the conversion of the peat into a fertilising material by means of a microbiological process, the following summary of past investigations bearing on this subject has been compiled.

Two methods of treatment have been suggested.

1. A treatment designed to render the peat available as a nitrogenous fertiliser.
2. A treatment designed to render the peat available as a carbon dioxide fertiliser.

PEAT AS A NITROGENOUS FERTILISER.

In 1912, Bottomley (1) announced that when peat was treated with certain aerobic soil organisms, the insoluble humic acid, which was present in this material in large quantities, was converted into soluble ammonium humate, a substance capable of supplying the nitrogen needs of plants, providing soluble phosphates and potassium salts were present. Further he reported (2) that this 'bacterised' peat after being sterilised formed an excellent medium in which to grow and distribute non-symbiotic nitrogen-fixing bacteria, and that an aqueous extract of bacterised peat supplied all the plant food necessary for water cultures with tomatoes, barley, etc. Experiments conducted on various pot plants produced evidence that bacterised peat possessed growth stimulating properties not to be accounted for by any known mineral constituents present. The stimulating substances were soluble in water, and effective in very minute quantities, and it was suggested that they were similar in function to the accessory food bodies (vitamines) concerned in animal nutrition. A long series of experiments were carried out with *Lemna* and other aquatic plants from which it was deduced that these stimulating substances or 'auximones' were essential for normal plant growth (3,4). Clark and Roller (5) who repeated Bottomley's experiments some years later came to the conclusion however that the normal growth of *Lemna* in mineral solutions was dependent merely on a suitable concentration of salts, and that auximones were not essential, but it was possible that they functioned as accelerators.

Bottomley secured several patents for the manufacture of bacterised peat, or 'Humogen' as it came to be called, and various field and pot trials were under-

taken. When used as a fertiliser on moorland soils the yield of oats and mangolds were said to have been doubled (6). At Woburn, in the first season's trials, bacterised peat was compared with heated fen soil, a substance which had previously been used with good effect. In the case of mustard and barley, treatment with bacterised peat resulted in a definite increase in yield (7). In the following season the value of the nitrogen in the treated peat was compared with that in sodium nitrate. With oats the yield of grain was about the same, but bacterised peat produced a marked increase in the yield of straw. With mustard, treatment with peat gave a clear advantage. Nevertheless it was held that 'the value of bacterised peat for farm crops has yet to be established' (8). Field trials carried out at the Midland Agricultural and Dairy College with wheat, 'seeds' hay and potatoes were entirely negative (9).

In response to a request made by the Board of Agriculture trials were conducted in 1916 at Rothamsted, the results of which have been summed up in a report by Russell (10). There was no evidence that Humogen possessed any special agricultural value or that it was any better than any other organic manure with the same content of nitrogen. Bottomley claimed that the failure of these Rothamsted experiments was due to the use of lots of Humogen which had been wrongly prepared, and as the result contained an excess of sodium carbonate.

In 1916 Makrinoff (11), at that time ignorant of Bottomley's work, began in Russia a series of field experiments designed to determine whether it was possible to improve soil fertility by the introduction of micro-organisms. It was recognised that in some soils the non-symbiotic nitrogen fixing bacteria (*Azotobacter* and *Clostridium*) are insufficiently provided with the carbonaceous matter which is essential as a source of energy. Pringsheim (12) and Koch (13) had arrived at the conclusion that the calcium salts of the various organic acids, formed as the result of the decomposition of cellulose by aerobic cellulose bacteria, were a suitable source of carbon for nitrogen-fixing bacteria. With this in mind Makrinoff assumed that the addition of cellulose bacteria and *Azotobacter* to peat soils fertilised with mineral manures would exert a favourable influence on their fertility, and in order to test this hypothesis, four plots were laid out on virgin peat soil which received the following treatment:

(1) Control; (2) Minerals only; (3) Minerals + *Azotobacter*; (4) Minerals + *Azotobacter* + aerobic cellulose bacteria.

The plots were sown with oats and the following crops harvested:

(1) No crop; (2) 16 pounds; (3) 41 pounds; (4) 57 pounds.

Conclusions.

In spite of the unfavourable verdict which followed the Rothamsted trials of Humogen, the remarkable results obtained by Bottomley in his earlier experiments both with water cultures and with pot plants at Kew and at Chelsea, the undoubted stimulation of the growth of *Lemna* by the addition of minimal

quantities of bacterised peat extract, and the favourable results of the Woburn trials would alone show that his work cannot be summarily dismissed, but when also Makrinoff's experiments are taken into consideration it seems evident that the whole question is worthy of further investigation.

Whether either Bottomley's theory, that the aerobic cellulose bacteria convert 'insoluble humic acid' into 'soluble humates', or the conclusion of Pringsheim and Koch, that the decomposition induced by these organisms results in the production of organic acids, whose calcium salts form an energy source for nitrogen-fixing bacteria, is correct, does not affect the fact that both Bottomley and Makrinoff appear to have shown that when raw peat is acted upon by certain aerobic organisms and then inoculated with *Azotobacter* it becomes converted into a medium which is able to stimulate and support the growth of crop plants.

Finally some support for their claims is to be found in the recent work of Itano (14) who as the result of a biological investigation of peat is of the opinion that there is a possibility of rendering this material available as a nitrogenous fertiliser when its H-ion concentration has been corrected, and certain accessory substances have been added to stimulate the growth of the micro-organisms already present.

PEAT AS A CARBON DIOXIDE FERTILISER.

The consideration of this aspect of the subject is concerned not only with the question whether peat can be converted into an efficient carbon dioxide fertiliser, but also whether carbon dioxide fertilisation is of any practical value.

Carbon Dioxide Fertilisation.

The practice of carbon dioxide fertilisation is based on the theory that the carbon dioxide content of the atmosphere surrounding crop plants is not at an optimum for their growth and that their development can therefore be stimulated by increasing the supply of this gas.

The experimental evidence bearing on this subject can be reviewed under two headings.

1. Experiments with closed atmospheres (glasshouse trials).
2. Experiments with free atmospheres (field trials).

1. **Experiments with closed atmospheres.**—Timmis (15) working at the Cheshunt Experiment Station found that when a closed glasshouse was exposed to bright sunlight for three hours the carbon dioxide concentration of its atmosphere was reduced. Owen and Williams (16) working at the same station stated that the yields of tomatoes were increased as much as 25% by the evolution of a continuous supply of carbon dioxide from the soil surface and further (17) that treatment with 0.6% carbon dioxide for one hour daily resulted in a distinct benefit to the crop. Preliminary work at the Ohio Experiment Station

(18) is said to have shown that a 26% increase in the yield of lettuce could be obtained by the addition of small amounts of carbon dioxide. In continuation of the Cheshunt experiments, Owen and Small (19) demonstrated that yields of cucumbers were also markedly benefited by treatment with carbon dioxide.

These results have been confirmed in Germany by Muth and Voigt (20), Lobner (21), Kochs and Hosterman (22) and the Rhine Province Horticultural Station (23).

A critical study of carbon dioxide fertilisation in closed atmospheres is now being undertaken at the Imperial College where Blackman (24) has already shown that with a given light intensity the growth of cucumbers can be increased 85% in eleven days by raising the carbon dioxide concentration.

2. Experiments with free atmospheres.—The evidence on this aspect of the subject is so contradictory that, for the sake of clearness, it is best grouped as 'negative' and 'positive'.

Negative evidence.—Spirgatis (25) maintained that an increase in the carbon dioxide content of the air can only give an increase in yield if the light factor is depressed, and that the carbon dioxide present in the atmosphere is sufficient under normal conditions for the production of maximum crops. Lemmerman and Kaim (26) found that there was no evidence that the carbon dioxide content of the air over soils lightly fertilised with farmyard manure is greater than the average carbon dioxide content of the atmosphere. Densch and Hunnius (27) studied the effect on field crops of increasing the supply of carbon dioxide and failed to observe any increase in yields. Appleman (28) increased the carbon dioxide content of the soil air by the incorporation of organic matter and observed that the development of potatoes growing in this higher concentration was retarded, but increased and equalled that of the control when the carbon dioxide concentration was reduced by cultivation. Lemmerman (29) has recently shown that although large amounts of carbon dioxide are liberated from the soil when organic manures are applied, this increased supply is not very important for the carbon nutrition of plants owing to air movements which rapidly remove it.

Positive evidence.—Lundegardh (30) came to the conclusion that it was possible by fertilisation to produce an atmosphere surrounding crop leaves enriched in carbon dioxide, and that (31) the carbon dioxide of the soil atmosphere was a more important source of carbon for the growth of plants than the carbon dioxide of the air. Muth and Voigt (20) stated that the yield of cabbages could be stimulated by applications of carbon dioxide in the open air. More recently Lundegardh (32) has announced that the general indication of numerous experiments is that a carbon dioxide supply up to or approaching the limit of tolerance markedly increases the yield of total dry matter in a crop. A particular striking experiment consisted in placing impervious troughs in furrows between rows of beets and filling the troughs with farmyard manure. Although no part of the manure save the evolved gas reached the plants an increase in yield was produced. Reinan (33), who is the author of a book on this subject, is of the

opinion that carbon dioxide fertilisation can be practically and economically applied in the growing of almost any crop.

Conclusions.

That carbon dioxide fertilisation is of value in the cultivation of glasshouse crops seems to have been clearly established. On the other hand the evidence in regard to field crops is extraordinarily inconsistent. Lundegardh's trough experiment is significant, but it needs confirmation. Nevertheless that under some conditions of light intensity, the carbon dioxide content of the atmosphere (at least in temperate climates) is a limiting factor for the growth of certain crops is evident from Blackman's statement (34) that a cereal or clover crop employs in the manufacture of plant material only 1 to 3% of the energy of the sun which reaches the ground, this low efficiency being largely due to the low concentration of carbon dioxide available for the process of food manufacture; and furthermore that with high concentrations of carbon dioxide and weak light the plant may work with an efficiency of nearly 60%.

Peat as a Carbon Dioxide Fertiliser.

According to statements made in the local press (36) a microbiological process has been devised by means of which peat, among other substances, can be rendered available as a carbon dioxide fertiliser, and it is claimed that considerable increases in crop yields can be obtained when this treated peat or 'Biochemica' is applied to the soil.

However only one reference to trials of peat as a source of carbon dioxide can be found. Gerlach and Seidel (35) carried out tests of an alleged carbon dioxide fertiliser containing 30% of peat, 15% of carbonaceous material and 5% of so-called catalytic material. No increase in crop yields were obtained and in some cases yields were diminished.

Conclusions.

There is no reason to believe from the available evidence that peat or treated peat has yet been proved to be an efficient carbon dioxide fertiliser.

References.

1. Bottomley, W. B. — Rept. Brit. Ass. Adv. Sci., 680, 1912.
   Rept. Brit. Ass. Adv. Sci., 706 and 777, 1913.
2. Bottomley, W. B. — Ann. Bot., 28, 531, 1914.
3. Bottomley, W. B. — Proc. Roy. Soc. B., 88, 237, 1914.
   Rept. Brit. Ass. Adv. Sci., 728, 1915.
   Proc. Roy. Soc. B., 89, 481, 1917.
   Proc. Roy. Soc. B., 90, 39, 1917.
   Proc. Roy. Soc. B., 91, 83, 1919.
   Ann. Bot., 34, 345 and 353, 1920.

4. Mockeridge, F. A. — Proc. Roy. Soc. B., 89, 508, 1917. Biochem. Journ., 14, 432, 1920.
5. Clark, N. A. and Roller, E. M. — Soil Sci., 17, 193, 1914.
6. Bottomley, W. B. — Rept. Brit. Ass. Adv. Sci., 501, 1916.
7. Journ. Roy. Agric. Soc., 1914, abstr. in Journ. Bd. Agr. (U.K.), 22, 464, 1915.
8. Journ. Roy. Agric. Soc., 1915, abstr. in Journ. Bd. Agr. (U.K.), 23, 271, 1916.
9. Rept. Midland Agric. and Dairy Coll., abstr. in Journ. Bd. Agr. (U.K.), 22, 1297, 1915.
10. Russell, E. J. — Journ. Bd. Agr. (U.K.), 24, 11, 1917.
11. Makrinoff, I. A. — Soil Sci., 17, 31, 1924.
12. Pringsheim, H. — Centrbl. Bakt., 2, 23, 300, 1909. Centrbl. Bakt., 2, 26, 222, 1910. Biol. Centrbl., 31, 65, 1911.
13. Koch, A. — Handb. Techn. Mykol. Lafar, 3, 1, 1904.
14. Itano, I. — Journ. Bact., 10, 87, 1925.
15. Timmis, L. B. — Ann. Rept. Expt. and Research Sta. Cheshunt, 8, 57, 1922.
16. Owen. O. and Williams, P. H. — Ann. Rept. Expt. and Research Sta. Cheshunt, 9, 82, 1923.
17. Owen, O. and Williams, P. H. — Ann. Rept. Expt. and Research Sta. Cheshunt, 10, 105, 1924.
18. Ohio Sta. Bull. 382, 39, 1924.
19. Owen, O. and Small, T. — Ann. Rept. Expt. and Research Sta. Cheshunt, 11, 119, 1925.
20. Muth, F. and Voigt, C. — Landw. Jahrb., 64, 120, 1926.
21. Lobner, M. — Obst. u Gemusebau, 73, 300, 1927.
22. Kochs and Hosterman. — Landw. Jahrb., 57, 112, 1922.
23. Veroflentl. Landw. Kammer. Rheinprov., 11, 14, 1927.
24. Blackman, V. H. — Journ. Min. Agric., 33, 816, 1926.
25. Spirgatis, P. — Bot. Archiv., 4, 381, 1923.
26. Lemmerman, O. and Kaim, H. — Zeitschr. Pflanzenernahr. u. Dungung, 3, 1, 1924.
27. Densch, A. and Hunnius, T. — Zeitschr. Pflanzenernahr. u. Dungung, 2, 241, 1923.
28. Appleman, C. O. — Soil Sci., 24, 241, 1927.
29. Lemmerman, O. — Proc. 1st. Internat. Congr. Soil Sci., 305, 1928.
30. Lundegardh, H. — Arkiv. Bot., 18, 36, 1923.
31. Lundegardh, H. — Klima und Boden in ihrer Wirkung auf das Pflanzenleben. Jena 1925.
32. Lundegardh, H. — Soil Sci., 23, 417, 1927.
33. Reinau, E. — Praktische Kohlensaure dungung in Gartnerei und Landwirtschaft. Berlin, Julius Springer, 1927
34. Blackman, V. H. — Year Book, Essex Farmers' Union, 1927.
35. Gerlach and Seidel. — Zeitschr. Pflanzenernahr. u. Dungung 4, 241, 1925.
36. Article entitled 'Biochemica' in 'Malaya Tribune', Singapore. March 2nd. 1929.

THE UTILISATION OF SISAL WASTE FOR PRODUCTION OF ALCOHOL.

BY

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Acting Agricultural Chemist.

Interest in the utilisation of sisal waste has been aroused by patenting* of a process for the extraction and alcoholic fermentation of sisal juice and by an investigation on similar lines carried out in Kenya.†

Since sisal has been shown to be suited to Malaya, an investigation of the potentiality of its waste for the production of alcohol was carried out on leaves from plants growing at Serdang Experimental Plantation.

Fresh leaf from four year old plants was found to contain 3% sugars of which 2·6% was reducing sugars: the juice extracted from the leaf contained 3·5% sugars of which 3% was reducing sugars.

Composition of Fresh Sisal Leaf.

Total sugars	3·0 per cent.
Recoverable fibre	3·6 ,,
Moisture	85·0 ,,
Waste cellulose (by difference)	8·4 ,,
	100·0 per cent.

The sugar content of the juice of sisal leaf in Kenya was found to increase from 1·0 per cent up to a maximum of 4·9 per cent at the age of four years and then decrease again. Figures for the sugar content of sisal leaf in Kenya are not given.

The economics of the process were investigated in Kenya and the conclusion arrived at was that only with a juice containing as much as 8·5 per cent sugar could the process be worked economically: with the sugar content the final cost of the alcohol per gallon was estimated at 4d. The cost in the case of juice containing 3 and 4 per cent of sugar was estimated at 1/- and -/9d. respectively. The possibility of fermenting the cellulose fraction of the waste was also considered in Kenya but found to be too expensive for economical exploitation: this residue would be useful only as fuel.

The conclusion derived from this investigation is similar to that arrived at Kenya, namely that on account of the low sugar content of the juice, profitable exploitation of the waste for the production of power of alcohol is not possible.

* British Specification No. 301, 284. 1928.

† Colony and Protectorate of Kenya, Bulletin No. 6 of 1929.

ABSTRACTS.

SECONDARY LEAF-FALL OF RUBBER.*

This disease is caused by a mildew fungus known as *Oidium Heveae* Steinm. which attacks the flowering spikes of the rubber tree and the young leaves as they develop after the 'wintering' period.

During the course of a visit to the southern part of the Negri Sembilan, the Territory of Malacca and the north of Johore, the disease was found to be present on seventeen estates and in most small holdings along the road side; in fact a heavy infection was observed in all rubber areas along the route taken. Observations made on this occasion together with supplementary records showed that the area of infection included the whole of Selangor, Negri Sembilan, Malacca Territory and North Johore.

Infection of the inflorescences was complete in all districts, but the leaf infection was most severe in Malacca and southern Negri Sembilan and decreased with the increase in distance from these areas.

It was observed that very few inflorescences remained on the tree and that very few flowers opened to maturity. Early wintering trees had, almost without exception, failed to set fruit and late wintering trees, though bearing a heavy flush of flowers, were all so heavily infected with the fungus that few if any flowers would ever reach maturity.

The mildew fungus usually attacks only young leaves from $\frac{1}{2}$ to 2 inches long, though investigators in Ceylon and the Dutch East Indies report that older leaves may also be attacked. Many of the young leaves die and fall from the trees, so that the presence of a number of these young leaves on the ground serves as an indication of the presence of the disease.

Leaves may apparently recover from an attack, but remain for a long time in a weak pendant condition, eventually extending to give malformed, wrinkled, pale or mottled leaves, many of which are so weak as to be forced off the tree by subsequent rain or wind.

The causative fungus can be easily demonstrated, particularly with the aid of a hand lens, on the flowers and flower stalks, on the latter of which its presence is characterised by a glistening powdery appearance. On the leaves

* Abstracted from a "Report on a Visit to the Malacca Territory and Southern Negri Sembilan to Investigate the Occurrence of *Oidium Heveae*", by F. Beeley, Field Officer of the Rubber Research Institute of Malaya. A copy of this report was kindly supplied by the Acting Director of the Institute with permission to abstract it in advance. The full report will appear in the next number of the Quarterly Journal of the Institute.

the fungus is often very difficult to see, though when the leaf surface is viewed in certain angles of light, a vigorous growth of the fungus may become visible to the naked eye as a slight, glistening, furry surface distinguishable from the otherwise smooth leaf surface.

A few trees were observed to have their second flush of young leaves heavily infected. Such foliage was light, weak and pale yellow green in colour.

The extent of actual leaf fall appeared to be in proportion to the weight of foliage normally produced by the trees. Trees in good soil bearing thick foliage suffered a heavier fall of leaf than those in poorer soil bearing thinner foliage, but the former class of trees made a far more rapid recovery. The flowers in all cases were almost completely destroyed.

The disease was observed on trees of all ages over $2\frac{1}{2}$ years. Partial wintering of young trees of 2 to 4 years old caused the attack in such clearings to appear only on a few branches of which the leaves were sufficiently immature to be susceptible.

No special type of tree appeared to be affected to a greater extent than any other type. The taller trees appeared to suffer more than those of normal height within the same area. Closely planted small holdings of rubber appeared to have shed more leaves than more widely planted estate trees, as evidenced by the amount of green leaf on the ground; but the apparently larger quantity of such fallen leaf in small holdings may have been due to the more humid conditions resulting from close planting, since these conditions would tend to cause a slower discolouration and decomposition of the young fallen leaves.

No immune trees were observed.

Soil types, covercrops and period of resting from tapping did not appear to have any influence on the incidence or severity of the attack, neither did the application of manures appear to have much effect. Only in a few cases where applications of nitrogenous manure had delayed wintering sufficiently to make the arrival of the young leaves coincident with the arrival of wet weather had the the developing foliage excaped the disease to some extent.

The amount of rainfall seems to have an all-important influence on the severity of attack, especially on the leaves, since in the two years 1928 and 1930, when the first quarter of the year was abnormally dry, the disease was much in evidence, while in the corresponding period of 1929 when normally wet weather was experienced very few cases of mildew were recorded.

The association of mites with Oidium Leaf-fall was not borne out by these investigations. Mites were only present in advanced stages of the disease, when the mildew fungus was difficult to find and decomposition had commenced.

Owing to the very widespread infection the method of spread could not be determined. In all probability infection is caused by wind borne spores. No clue as to the type and location of a resting spore was found.

The possible effect of the disease upon the yield of rubber per acre was an important part of the investigation.

The results of this part of the work were, however, extremely disappointing. The effect of the disease itself was masked by the influence of a number of other factors affecting yields, such as the drought, changes in the position of the tapping cut, introduction of soil conservation schemes, changes in the nationality of tappers and periodic resting of trees, which had been in operation during recent years on the estates visited. It is however, important to establish the extent to which the disease affects yield, in order to ascertain if control measures can profitably be put into operation.

Fortunately experience so far shows that climatic conditions in Malaya are unsuited to a prolonged activity of the fungus and, therefore, extensive losses due to mildew attack are not to be expected. The chief effect will be felt in the seed harvest on account of the destruction of the flowers. Lack of seed for future planting programmes is therefore more likely to cause anxiety than is the possibility of an appreciable reduction in yield.

SECONDARY LEAF-FALL OF RUBBER—A NOTIFIABLE DISEASE.

The attention of owners and managers of land planted with rubber is invited to notification No. 859 in the Straits Settlements Government Gazette of May 2nd, 1930 and to notification No. 3129 in the Federated Malay States Government Gazette of May 9th 1930. The effect of these notifications is to add Secondary Leaf-fall of rubber trees caused by the fungus *Oidium Heveae* Steinm. to the Schedule of diseases and pests the presence of which on estates and small holdings in the Straits Settlements and Federated Malay States is notifiable under the "Pests Notification Rules" of 1925 and 1927. Similar action is under consideration in Johore. In consequence of these notifications the presence of secondary leaf-fall on any rubber trees must be reported within two weeks of finding it to the Director of Agriculture or the Agricultural Field Officer in the area in which the disease is discovered, in the case of the Straits Settlements and Federated Malay States, and to the Principal Agricultural Officer, Johore, if similar action is required in that State. This action has been taken in order that the Department of Agriculture may be fully informed of the present extent and future spread of the infection and be in a position to take action to control the disease, should this prove necessary.

REVIEW.

THE BRAZIL NUT IN MALAYA.

BY

J. LAMBOURNE.

Special Bulletin. General Series No. 2. Department of Agriculture, S.S. & F.M.S. 14 pp. 6 pls. Kuala Lumpur. March 1930. Price fifty cents.

This publication gives a botanical and historical survey of the Brazil nut tree in Malaya. It is shewn that the plant was introduced to Singapore in 1881, and was planted in Kuala Lumpur in 1912, commencing to fruit some ten years later. Observations on the variability of the trees and also of the nuts produced is given in some detail.

The method of cultivation of the tree is described and a statement given of the yields obtained from the Kuala Lumpur trees for the past five years. Favourable reports on samples submitted to London importers are reproduced and also notes on the handling of the crop in Brazil.

The Author concludes that the Brazil nut tree is unlikely to be of commercial importance in Malaya on account of the length of time it takes to reach the bearing stage and the relatively small crops obtained at least in the early years of fruiting. On the other hand, it is very desirable that it should be planted on a small scale around private dwellings for home consumption.

We would go further in suggesting that the tree is suitable for cultivation in native holdings, where it would form a useful addition to the fruits grown and might prove of profit to the owners in years to come, as the fruit would find a ready local sale.

D.H.G.

FROM THE DISTRICTS.

The Weather.

In general there was a good normal rainfall during the first half of the month, followed by dry weather modified as in Southern Perak and Selangor by occasional showers, or as in Western Pahang by a few days of wet weather at the close of the month. In Perak North and Malacca the month was on the whole dry with showers at the beginning of the month and in Malacca further showers towards its end.

Rubber.—The great majority of large estates have observed the May tapping holiday and have utilised their labour forces for work on general maintenance including measures for soil conservation. On the other hand most of the owners of small holdings have continued to tap their trees as usual, either because they could not afford to stop, or because they hoped to benefit from the rise in price which they expected would result from cessation of tapping on large estates.

Early in the month secondary leaf fall disease caused by *Oidium Heveae* was definitely found to be present on a few small holdings in Batang Padang District of Perak. Its presence was suspected in a number of areas in the same District and in Lower Perak, but by the end of the month the majority of the holdings had recovered, as had many infected estates and holdings in Selangor, Negri Sembilan and Malacca.

Padi.—The Krian padi crop is estimated to have been 10,845,380 gantangs. This is well below an average crop and is mainly accounted for by the complete failure of the very late planted padi in the mukims of Briah, Gunong Semanggol and Selinsing. Preparation of the land for next season's crop was commenced in most padi areas, the principal exceptions being those in Perak North. Wetter weather enabled transplanting from the nurseries to be effected in those mukims of Kuala Lipis and Temerloh districts which adjoin the Pahang river.

Oil Palm.—As a result of advice given on rat control an estate in Perak is not sowing a cover crop in its 1930 clearing. The use of sodium arsenite is proving effective in controlling rats in its older areas.

One estate in Johore is experiencing considerable trouble from white ants; their attacks frequently seem to follow weakening of the trees by crown disease which is present on about 20 per cent of the palms throughout the estate. A certain number of trees have also been attacked by root diseases of which the causative fungi are not yet definitely ascertained.

Tuba.—A beetle pest, probably *Nisotra* sp., occurs on tuba plants on three estates in Johore. On one of these a contact spray is stated to have proved very effective as a means of control at a reasonable cost per acre. Larvae and

pupae believed to be those of this pest have now been found in considerable numbers about three inches below the surface of the soil amongst the roots of the tuba.

Coffee.—A revision of the area planted with coffee in Malacca showed that it amounted to 428 acres, of which about half are interplanted with other crops. Most of the larger holdings are fairly well kept, except that pruning off suckers and side shoots and destruction of black berries and dead wood require more attention. The Agricultural Field Officer, Selangor, visited an estate in Kuala Langat district to arrange with the Manager a simple experiment on manuring coffee.

Tea.—The Agricultural Field Officer, Perak South, reports that stumps and basket plants are now exhibiting good growth in the area planted with tea to which reference was made on page 114 of the February number of this Journal. He adds that seedlings require constant supplying. He further remarks that the cover crop *Indigofera endecaphylla* is regenerating rapidly and that Albizzia stumps have been planted out and are growing well. *Indigofera endecaphylla* is also being used as a cover crop on a tea estate at a high elevation. *Grivillea robusta* has been planted on this estate as a shade tree and wind break.

Sisal Hemp.—Enquiries have been made for a suitable area of about 11,000 acres of land in Johore for the cultivation of this crop.

Fruit.—Durians have been fruiting in Penang, but the crop being harvested is small. The wholesale price at 15 to 20 cents each is high owing to the scarcity of fruit and the long distance which they have to be transported. A few mangosteens are on the market, but the fruit season is expected to be poor. In Malacca the main fruit crop is also expected to be below the average as the amount of young fruit on the trees is rather small.

Pineapples.—A large increase in the pineapple crop has occurred in Singapore during the month but it is expected that the maximum yield will be reached in June. Prices are poor for both the canned and fresh fruits. Pineapples have sold for 70 cents to $1.80 per hundred. Tinned pines vary between $3.25 and $3.75 per case, while the large tins are selling at $3.10 per case.

Notes on Demonstration Stations and Padi Test Plots.

Kuala Kangsar Demonstration Station.—Sales of produce from this station included 16,000 small oranges at 50 cents a hundred, 65 ducks eggs at 3 cents each and 45 hens eggs at 5 cents each. The vegetable area at this station is being planted up with local and imported seeds.

Records now show that the eggs of the pure-bred fowls at Kuala Kangsar will not hatch satisfactorily if they are kept for more than three days before being placed in the incubator. Since all attempts to hatch duck eggs in an incubator have failed, local broody fowls are being obtained for this purpose. Care is being taken to keep the local fowls isolated from the rest of the poultry owing to the danger of introducing disease.

Kuala Lipis Demonstration Station.—Two plots of soya bean, varieties E.B. 3 and 4, were planted during the month and have germinated well. Two varieties of maize and plots of groundnuts have made good growth. Planting material of sorghum, ginger, and the greater and lesser yam has been applied for from the Government Experimental Plantation, Serdang. All available suckers of bananas are being kept for sale, the supply being unequal to the demand.

Pringgit Fruit Station, Malacca.—Suckers of Sarawak pineapple and seedlings of Liberian and Robusta coffee, together with five seedlings of cashew nut were planted.

Pulau Gadong Padi Experiment Station.—In preparation for the coming season's crop, the drains and water courses received attention and further precautions were taken to prevent flooding. Preliminary ploughing of all plots was completed and the preparation of nurseries was in progress. Preparation of an area for a new series of manurial experiments was commenced.

Padi Test Plot.—Bukit Merah.—An area of 10 acres of Crown land in Province Wellesley recently reserved for this purpose is being prepared for planting as a padi test plot in the coming season.

Padi Test Plot, Glugor.—Arrangements are being made to lease 5 acres of land in Penang and it is intended to commence work on this site early in June.

Kuang Padi Test Plot.—An area of 3 acres has been leased at Kuang in Selangor and the preparation of the land is in progress. Strains to be tested are Seraup Kechil 36 and 48, Radin 2, 4 and 13 and Nachin Puteh 27. Seed of the Seraups has been planted in the nursery.

Kajang Paya Padi Test Plot.—The strains to be tested this year are Seraup Besar 15, and Radin 2, 4 and 13. The Seraup has been planted in the nursery. Owing to a breach in the dam the supply of water has been insufficient to enable much progress to be made with the preparation of the land.

Dong Padi Test Plot.—Nurseries of the following eleven strains to be tested this year were sown on May 14th and 15th i.e. Seraup Besar 15, Seraup Kechil 52, 48 and 36, Radin 13, 7, 4, 3, and 2, Padi Pahit No. 1 and the local padi Jambak Bawang. The short period dwarf strain Serendah 875 will be sown in June.

Temerloh Padi Test Station.—The land was dug over with "changkols," a method of preparation which is somewhat unusual in this district where preparation is usually done by means of the hands only. Nurseries of Radins 13, and 7 made good growth. The strain Serendah 875 will be planted in June.

Plant Distributions.

One thousand gantangs of pure strain padi Radin 2 were obtained from growers at Talang, Kuala Kangsar and sent to the Economic Botanist for distribution.

In Pahang 600 gantangs of hill padi seed were collected from the mukims of Talang and Sega and despatched to Temerloh District for planting. There is a demand for a further supply of 800 gantangs of seed if this can be obtained.

Small quantities of seed of the pure strains Nachin 10, 22, and 48 and Siam 29 and 77 from the Experiment Station at Pulau Gadong have been sent for trial in Krian and in Kedah and a supply of about 100 gantangs has also been sent to Chabau in Malacca for seed purposes.

In Province Wellesley vegetable seeds were distributed to school gardens.

School Gardens.

In Province Wellesley the first half yearly inspection of all the 20 Gardens was carried out for the purpose of awarding marks for the annual competition. Some good work has been done though the gardens have only been planted a few weeks.

In Perak satisfactory progress has been made in the majority of school gardens inspected. The Agricultural Field Officer, Perak South and certain of his Malay officers have given demonstrations on cultivation and planting during gardening hours.

Elsewhere replanting gardens is progressing fast and work in general has been satisfactory.

Shows.

It has now been decided to hold the Perak North Agricultural Show at Taiping on August 23rd and 24th. The dates fixed for the Seremban Show are July 25th and 26th for the Malacca Show July 25th and for the Kuantan Show August 26th. A show has also been arranged at Alor Star, Kedah, on July 10th and 11th.

Rats.

In Province Wellesley rewards were paid for 137,345 rats tails during the month, making a total for the first five months of the year of 446,706. Poison balls distributed amounted to 12,370.

In Krian 118,696 rats tails were collected and 12,900 poison balls were issued.

In Malacca attention was paid to clearing away bushes and high grass adjoining rice lands in order to deprive rats of cover.

DEPARTMENTAL NOTES.

Honour for Dr. H. W. Jack.

His Majesty the King has been graciously pleased to confer the honour of Membership of the Most Excellent Order of the British Empire (Civil Division) on Henry Walter Jack.

Dr. H. W. Jack, B.A., D.Sc, joined the Department of Agriculture, S.S. & F.M.S., sixteen years ago. As a field officer, as an agricultural instructor and for the past eleven years as Economic Botanist Dr. Jack has devoted much of his energies to the improvement of the varieties of rice grown in Malaya. His researches into the subject have resulted in the establishment of strains of padi capable of yielding increased crops up to 30% of the normal.

The technique required for the accomplishment of this work and the detailed work in connection with the researches have been published in the *Malayan Agricultural Journal* and in Special Bulletins of this Department.

Demonstrations to Chinese Agriculturists at the Experimental Plantation, Serdang.

On May 7th, sixty-two Chinese agriculturists, mainly from the Sungei Balak Settlement, attended a demonstration on tea cultivation and manufacture at Serdang.

The party was conducted around the plantation by Mr. Kanagaratnam, farm assistant, who explained in detail the various processes which were seen in operation, the interpretation being done by Mr. Lau Sing Nam, Chinese Sub-Inspector of Agriculture.

Although the party exhibited a sense of disappointment when confronted by the mechanical roller and roll breaker, maintaining that the employment of machinery was beyond their means, they were reassured however on learning that the principles demonstrated could be efficiently achieved without machinery, and that no further mechanical means were employed in the various processes of manufacture.

On the manufacturing side, the method employed at Serdang for withering attracted attention. This method of withering appeared to be entirely new to them, and the simplicity of the process, together with the cheapness and efficiency of the structure employed, made an irresistable appeal. It is probable that most of the gardeners will instal similar racks for their own use, thus displacing the present practice of withering over a fire.

Considerable interest was maintained throughout the tour in the field. The gardeners were greatly impressed by the system of seed germinating in

sand beds, and the high percentage of germination obtained in comparison with the methods employed by themselves, i.e. seed beds of ordinary soil.

The area of mature tea caused considerable surprise and appreciation on account of the size and shape of the bushes. Methods of cultivation and pruning were fully explained. In the matter of soil conservation, which is of prime importance on the steep undulating land at Sungei Balak, the construction of contour silt pits had little attraction for the cultivators on the score of expenses, but they were highly interested in the cover crop *Indigofera endecaphylla* as a means to that end.

Apart from the management of tea, the gardeners were very interested in the pure bred pigs, being more attracted by the Middle White than the Large Black.

On the whole, this first demonstration to Chinese gardeners at Serdang was an unqualified success, as apart from the value of any useful information that the gardeners may have acquired, it has gone a long way towards establishing confidence and friendly relations between this Department and a large body of intensely conservative and highly suspicious agriculturists.

MARKET PRICES.

May, 1930.

Rubber.—The average price of rubber for the month of May was 6.9 pence per lb. London and 23.36 cents per lb. Singapore. This compares with 7.3 pence and 24.68 cents per lb. respectively for the previous month. The fluctuation during May were but slight, the lowest Singapore quotation being 22.75 cents and the highest price 24 cents.

Copra.—Average copra prices shew a decline of 16½ cents to $8.63½ per picul for F.M. quality; and a decline of 15 cents to $9.15 per picul for S.D. quality. Singapore shipments for the latter amounted to 1,675 tons.

Gambier.—Average Singapore prices for May:—Block $8.38; Cube $16.10 per picul compared with $8.76½ and $18.00 respectively for April, and $8.97 and $15.75 per picul respectively for March.

Nutmegs.—A further sharp decline is to be recorded for average Singapore values during May: 110 per lb. $29.60 per picul against $34.00 for the previous month; 80 per lb. $36.20 against $37.65 per picul in April.

Pepper.—Singapore prices for black pepper averaged $38.20 per picul compared with $45.00 in April; $51.42 against $55.06 per picul for White Sarawak Shipments 162 tons, black pepper, 153 tons white.

Rice.—Singapore average prices: Siam, $370; Saigon, white, $269; Rangoon, white, $249—all per coyan. Corresponding average prices in April were $365.75; $262.75; $244.25.

Sago.—Average Singapore prices for May were as follows:—Pearl, fair, $6.37½ (203 tons shipped) compared with $6.50½ per picul in April. Flour $3.85 compared with $3.96 per picul in April, 1,591 tons shipped.

Tapioca.—Average Singapore prices for May; Flake, small, fair $4.81 (1,024 tons shipped) compared with $5.32½ in April: Pearl fair, $6.95 per picul, (259 tons shipped) compared with $7 per picul in April.

The above market prices are based on the daily cabled London quotations for rubber; on the Singapore Chamber of Commerce Market Reports covering the period of 21st April to 24th May, 1930, and on other local sources of information.

1 coyan = 40 piculs. 1 picul = 133½ lbs.
The dollar has been fixed at 2 shillings and 4 pence

RETURN OF AREA NEWLY PLANTED WITH RUBBER IN THE FEDERATED MALAY STATES, DURING 1929.

State.	District.	Area Planted on Holdings. Under 100 acres. Acre.	R.	P.	100 acres & over. Acre.	R.	P.	Total. Acre.	R.	P.
Perak	Bruas & Parit	1,257	1	02	...	...	...	1,257	1	02
	Kuala Kangsar	311	1	03	969	0	00	1,280	1	03
	Lower Perak	20	1	00	92	0	00	112	1	00
	Sitiawan	120	2	19	452	3	24	573	2	03
	Kinta	...	...	...	212	2	00	212	2	00
	Ipoh	25	3	34	...	...	...	25	3	34
	Krian	...	...	...	470	3	11	470	3	11
	Upper Perak	579	3	04	63	0	00	642	3	04
	Batang Padang	655	3	09	524	3	36	1,180	3	05
	Larut & Selama	2,450	0	34	...	...	...	2,450	0	34
	Total	5,421	0	25	2,785	0	31	8,206	1	16
Selangor	K. Selangor and S. Bernam	90	1	02	176	3	12	267	0	14
	K. Lumpur	...	...	...	191	2	01	191	2	01
	Klang	477	0	00	380	0	00	857	0	00
	Sepang	193	0	02	...	...	...	193	0	02
	K. Langat	347	2	04	...	...	...	347	2	04
	Ulu Selangor	934	0	00	123	0	00	1,057	0	00
	Ulu Langat	360	0	00	226	1	00	586	1	00
	Total	2,401	3	08	1,097	2	13	3,499	1	21
N. S'bilan	Jelebu	479	2	34	165	0	00	644	2	34
	Port Dickson	1,700	0	00	...	...	...	1,700	0	00
	Seremban	512	0	00	1,206	0	00	1,718	0	00
	Tampin	1,096	1	14	356	0	10	1,452	1	24
	Rembau	178	0	12	...	...	...	178	0	12
	Kuala Pilah	0	3	05	147	0	00	147	3	05
	Total	3,966	3	25	1,874	0	10	5,840	3	35
Pahang	Kuantan	229	1	17	103	0	00	332	1	17
	Raub	574	0	00	271	0	00	845	0	00
	Pekan	365	2	36	...	...	...	365	2	36
	Kuala Lipis	1,212	0	00	680	0	00	1,892	0	00
	Bentong	147	0	00	1,696	0	00	1,843	0	00
	Temerloh	509	0	00	792	0	00	1,301	0	00
	Total	3,037	0	13	3,542	0	00	6,579	0	13

SUMMARY OF PLANTED AREA (F.M.S.) DURING 1929.

Total Perak	5,421	0	25	2,785	0	31	8,206	1	16
„ Selangor	2,401	3	08	1,097	2	13	3,499	1	21
„ N. Sembilan	3,966	3	25	1,874	0	10	5,840	3	35
„ Pahang	3,037	0	13	3,542	0	00	6,579	0	13
Grand Total—F.M.S.	14,826	3	31	9,298	3	14	24,125	3	05

J. Gordon-Carrie,

Deputy Registrar—General of Statistics, S.S. & F.M.S.

MALAYA RUBBER STATISTICS.

STOCKS OF RUBBER INCLUDING LATEX AND REVERTEX HELD BY DEALERS AND ESTATES OF 100 ACRES AND OVER, THE DECLARED PRODUCTION OF THE SAME ESTATES, IMPORT AND EXPORT FIGURES, AND ESTIMATED FIGURES OF THE PRODUCTION OF ESTATES OF LESS THAN 100 ACRES, FOR THE MONTH OF APRIL 1930, IN DRY TONS.

Territory	Stocks at beginning of month			Production by estates of 100 acres and over		Production by estates of less than 100 acres (estimated)		Imports				Exports (including re exports)				Stocks at end of month		
								during the month		during the year 1930		during the month		during the year 1930				
	Ports	Dealers	Estates of 100 acres and over	during the month	during the year 1930	during the month	during the year 1930	Foreign	From Malay States	Foreign	From Malay States	Foreign	Local	Foreign	Local	Dealers	Estates of 100 acres and over	Ports
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)
MALAY STATES																		
Federated Malay States	...	11,730	13,038	11,137	46,740	7,785	38,876	...	8	...	26	13,538	5,135	64,161	23,170	11,059	13,966	...
Johore	...	2,151	4,480	3,440	14,113	3,221	15,619	...	1	...	4	1,097	5,607	4,255	26,839	1,671	4,918	...
Kedah	...	420	1,863	1,971	7,644	1,004	5,273	...	...	2	...	656	2,122	2,899	10,293	356	2,124	...
Perlis	..	22	6	8	34	13	57	...	...	...	...	Nil	29	Nil	103	14	6	...
Kelantan	...	210	158	316	1,160	186	1,679	4	Nil	17	Nil	76	506	295	2,628	176	116	...
Trengganu ...	...	...	...	...	...	...	...	Nil	Nil	Nil	Nil	Nil	178	Nil	759	...	...	...
STRAITS SETTLEMENTS																		
Malacca	...	2,179	1,666	1,226	5,061	*		Nil	1,868	Nil	5,063	3,103		15,223		2,291	1,831	...
Province Wellesley	...	159	505	459	1,925											106	546	...
Dindings	...	123	134	78	368	6,563	14,257	864	2,974	3,495	13,852	4,759	Nil	23,336	Nil	101	118	...
Penang	1,464	5,305	8	11	40											5,374	11	1,964
Singapore ...	3,662	31,734	345	203	946			10,037	8,726	38,773	44,847	22,288		84,567		33,265	348	4,128

ANALYSIS OF COLONY AND FEDERATED MALAY STATES DEALERS' STOCKS AT END OF MONTH, IN DRY TONS.

Class of Rubber	Federated Malay States	Singapore	Penang	Province Wellesley, Dindings and Malacca	Johore	Gross total
(20)	(21)	(22)	(23)	(24)	(25)	(26)
Smoked sheet ...	8,353	13,254	3,645	1,466	700	27,418
Crepe	637	17,002	786	715	171	19,311
Unsmoked sheet ...	966	3,009	943	317	415	7,138
Scrap and lump ...	1,103				385	
Total all Grades ...	11,059	33,265	5,374	2,498	1,671	53,867

Notes.—1. Stocks on estates of less than 100 acres and stocks in transit on rail, road or local steamer are not ascertained.

2. The production of estates of less than 100 acres is estimated from the formula: Production + Imports + Stocks at beginning of month = Exports + Stocks at end of month; i.e., Column (7) = Columns (13) + (14) + (17) + (18) + (19) — (2) — (3) — (4) — (5) — (9) — (10).

3. Colony Dealers' Stocks are as published in Return I. & E. 6, dated April 10. The ratio of the reduction on wet rubber, taken from Dealers' returns, is 33.4% for Singapore and 26.4% for Penang.

4. Malay States Dealers' Stocks are reduced by the following fixed ratios: Unsmoked sheet, 15%; Wet Sheet, 25%; Scrap, Lump, etc., 40%.

5. Foreign Imports are as published in Return I. & E. 5, dated May 3, reduced to dry weight by the percentages for April in Note 3; (*S.S. Gazette* Notification No. 919/1930).

6. Foreign exports are those of each State and Settlement as published in the Malaya Monthly Trade Return (Appendix II), and are distinct from Ocean-Shipments as published in Return I. & E. 4, dated May 6.

7. The State of Trengganu has no organisation at present for the collection of returns of stocks and production; the latter can be estimated as approximately equivalent to exports.

8. All statements are brought up to date monthly and any inaccuracies that may be disclosed are corrected in the totals; the latest publication, therefore, is always the most reliable.

*9. This hypothetical figure, based on the formula quoted in Note 2, contains whatever errors exist in the Columns composing it and may therefore be expected to fluctuate from month to month. A truer indication of production will be the monthly average over as long a period, for which figures can be estimated, as possible.

KUALA LUMPUR,
Singapore, May, 19, 1930.

J. I. MILLER, M.C.S.,
Acting Registrar-General of Statistics, S.S. and F.M.S.

SUMMARY OF PADI RETURNS OF MALAYA FOR THE PERIOD OF APRIL, 1930.

State	Locality	Acreage of Padi Land			Acreage planted current season			Stage of Cultivation	Estimated Crop Harvested	Remarks
		Acres	R.	P.	Acres	R.	P.			
S.S.	Singapore -	—	—	—	—	—	—	—	—	—
	Malacca (Total)	35,499	0	00	29,648	0	00	Harvesting completed.	Total yield 10,073,821 gantangs.	Prospects of crop in all districts of Malacca are good except Alor Gajah, Coast and Jasin Inland mukims which were affected by late planting, short of water and flood damage.
	P. Wellesley (Total) -	39,640	0	00	38,120	0	00	Harvesting completed in all areas except P. Wellesley South which is progressing.	Total yield 5,939,997 gantangs.	Scattered area not included —560 acres. Yield 45,000 gantangs. Dry padi 350 acres—crop below average being insufficient water during growing period.
	Penang -	4,000*	0	00	2,842	0	00	Harvesting completed.	Total yield 1,201,500 gantangs.	Prospects fair. Irrigation available to limited area. Rats and stem borers have caused lot of damage.
	TOTAL:—S.S.	79,139	0	00	70,610	0	00		Total 17,215,318 gtgs.	* About 1,100 acres of this area are now planted with coconuts and rubber.
Perak	North -	53,250	0	00	46,660	0	00	About 13,500 acres harvesting in progress, balance completed.		Krian will most certainly prove to be below average. No estimate therefore can be given regarding yield at present. Crop in Briah, Selinsing and Gunong Semanggol is poor; the last two mukims will not produce any crop.
	K. Kangsar -	—	—	—	—	—	—	—	—	Kuala Kangsar, March returns completes the information for this season until returns are to hand from Land Offices of total crops actually harvested by the cultivators.

SUMMARY OF PADI RETURNS OF MALAYA FOR THE PERIOD OF APRIL, 1930.—(Continued)

State	Locality	Acreage of Padi Land			Acreage planted current season			Stage of Cultivation	Estimated Crop Harvested	Remarks
		Acres	R.	P.	Acres	R.	P.			
	Larut -	11,975	0	00	11,725	0	00	Harvesting nearly completed.	Total yield 2,303,750 gantangs.	
	Upper Perak -	3,877	0	00	3,739	0	00	Harvesting completed.	Total yield 1,251,700 gantangs.	Upper Perak. Acreages given differ from those given in last month's return. These are nearly correct as obtained at present but it is hoped more accurate acreage will be obtained next season.
	TOTAL: PERAK	69,102	0	00	62,124	0	00		Total yield 3,555,250 gantangs.	Scattered area—nil. Dry padi—201 acres only in Upper Perak.
Selangor	K. Selangor -	13,410	0	00	13,410	0	00	Completely destroyed owing to lack of water and pest damage.		**Note.** Except Kuala Selangor, all other areas have previously been dealt with.
Negri Sembilan	All Districts -	37,296	0	05	not yet planted			Preparing sawah.		
Pahang	West Area -	12,311	0	00				Nurseries.		
	East Area -	(Return by Quarterly only)								

(Sd.) W. GORDON CARRIE,
D.R.G.S.,
Statistician.--

METEOROLOGICAL SUMMARY, MALAYA.

APRIL, 1930.

Locality	Air Temperature in degrees Fahrenheit											Earth temperature		Rainfall									Bright Sunshine		
	Means of			Absolute Extremes										Total		Most in a day		Number of days							
	A. Max.	B. Min.	Mean of A and B	Highest Max.	Date	Lowest Min.	Date	Lowest Max.	Date	Highest Min.	Date	At 1 foot	At 4 feet			Amt.	Date	Precipitation*	Precipitation, 1mm. or more	Thunder-storm	Thunder heard	Fog morning obs.	Gale force 8 or more	Total	Daily Mean	Length of Day
	°F	°F	°F	°F		°F		°F		°F		°F	°F	in.	mm.	in.								hr.	hr.	hr.
Railway Hill, Kuala Lumpur, Selangor ...	93.0	73.0	83.0	96	Several	71	Several	89	8, 24	75	Several	84.7	84.8	10.01	254.3	1.72	27th	20	16	6	24	6		213.85	7.13	12.2
Bukit Jeram, Selangor ...	91.9	73.4	82.7	98	2nd	71	,,	86	8th	76	8th	89.0	89.9	4.75	120.7	1.87	30th	13	10	1	20	2		236.95	7.90	12.2
Sitiawan, Perak ...	90.9	73.1	82.0	95	2, 3	71	16, 18	86	22nd	76	8, 29	84.7	84.4	6.88	174.76	1.51	30th	18	16	17	27	...		235.25	7.84	..
Kroh, Perak ...	89.8	70.9	80.3	95	4th	66	17th	78	14th	75	23rd	83.1	84.3	6.77	172.6	1.20	20th	17	13	...	16	...		243.65	8.12	...
Temerloh, Pahang ...	93.3	73.0	83.1	97	9, 12	70	5, 11	91	Several	76	12th	87.3	86.9	6.86	174.2	3.07	10th	10	7	1	23	5		231.50	7.72	12.2
Kuala Lipis, Pahang ...	90.8	72.1	81.5	95	1, 10	70	Several	88	28th	74	Several	84.4	83.8	11.17	283.7	1.60	25th	18	16	19	21	15		232.65	7.75	...
Kuala Pahang, Pahang ...	88.2	75.4	81.8	92	13th	72	26th	85	14th	81	2, 3	87.4	87.0	3.58	90.9	1.03	13th	14	10	2	7	...		253.30	8.44	12.2
Cameron's Highlands, Rhododendron Hill, Pahang ...	73.3	60.1	66.7	77	5, 25	57	3rd	69	14th	61	Several	...	...	13.51	343.2	1.86	10th	22	21	10	25	5		168.10	5.60	12.2
Cameron's Highlands, Tanah Rata ...	74.1	55.4	64.7	77	11, 25	48	16th	71	14th	60	,,	69.4	69.0	12.47	316.7	1.34	10th	22	22	10	25	1		159.25	5.31	12.2
Fraser's Hill, Pahang ...	75.1	62.5	68.8	81	25th	61	Several	71	10th	64	,,	72.7	72.5	7.61	193.3	1.04	14th	19	15	...	26	28		180.90	6.03	12.2
Mount Faber, Singapore ...	88.5	75.1	81.8	92	Several	72	6, 7	82	11th	79	27th	82.1	83.3	9.91	251.7	2.50	10th	15	11	...	16	...		194.00	6.47	12.2
Butterworth, Province Wellesley ...	89.7	75.5	82.6	94	2nd	73	Several	86	22, 27	78	13th	87.7	86.1	11.45	290.8	2.98	1st	13	11	1	14	1		253.05	8.43	...
Bukit China, Malacca ...	87.0	74.5	80.7	92	2nd	72	14th	84	Several	76	Several	83.7	84.6	9.84	250.0	4.05	13th	15	14	5	9	...		219.40	7.31	12.2
Kluang, Johore ...	90.2	71.8	81.0	93	12th	70	Several	86	7, 23	74	4th	82.8	83.1	8.29	210.6	2.71	28th	17	15	3	20	18		198.85	6.63	12.2
Bukit Lalang, Mersing, Johore ...	88.7	72.7	80.7	91	Several	70	15th	84	11th	75	2, 23	82.6	81.8	6.02	152.9	1.85	13th	13	10	...	16	...		231.45	7.71	12.2
Alor Star, Kedah ...	91.9	73.6	82.7	95	,,	70	17th	87	24th	77	23rd	87.5	87.3	5.52	140.2	1.44	18th	17	13	3	20	...		268.60	8.95	...
Kota Bharu, Kelantan ...	90.6	73.3	81.9	94	27th	70	16th	85	18th	76	27th	84.7	83.8	1.49	37.9	0.69	17th	5	4	...	1	...		276.60	9.22	...
Kuala Trengganu, Trengganu ...	89.5	73.1	81.3	93	13th	71	Several	88	Several	75	Several	84.9	85.1	1.14	29.0	0.34	18th	8	6	...	6	3		283.75	9.46	...

*Precipitation .01 inch or more when measurement is in inches .2mm. or more when measurement is in millimetres.

Compiled from Returns supplied by the Meteorological Branch, Malaya.